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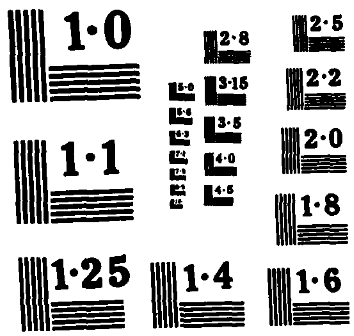

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Systems Engineering Service
Washington, D.C. 20591

Measurement of Radiated Emissions From Industrial Heating Device Equipment as it Relates to Aeronautical Services

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May 1985

Final Report

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16. Abstract

Described are the procedures, tests, and results of a program to measure the actual radiated emissions of two Industrial Heating Devices that have fundamental operating frequencies in the Non-directional Beacon bands (NDB). The radiated emissions testing was conducted at an FCC approved open field test site. Three different measurement methods were used to determine the radiated emissions in all directions around and above the IHD equipment. The results of the radiated emission measurements were also compared to the current CISPR allowable radiated emissions levels. The three test methods involve ground testing to FCC Part 18, subpart D, measurements made using a Clark tower and measurements made from an aircraft flying over the unit under test.

17. Key Words: Industrial Heating Devices (IHD); RF Radiated Emissions; Non-directional Beacon (NDB); Automatic Direction Finding (ADF); Airborne Measurements	18. Distribution Statement: This document is available to the United States public through the National Technical Information Service, Springfield, Virginia 22161

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English/Metric Conversion Factors

Length

From \ To	Cm	m	Km	in	ft	s mi	nmi
Cm	1	0.01	1×10^{-5}	0.3937	0.0328	6.21×10^{-6}	5.39×10^{-6}
m	100	1	0.001	39.37	3.281	0.0006	0.0005
Km	100,000	1000	1	39370	3281	0.6214	0.5395
in	2.540	0.0254	2.54×10^{-5}	1	0.0833	1.58×10^{-5}	1.37×10^{-5}
ft	30.48	0.3048	3.05×10^{-4}	12	1	1.89×10^{-4}	1.64×10^{-4}
S mi	160,900	1609	1.609	63360	5280	1	0.8688
nmi	185,200	1852	1.852	72930	6076	1.151	1

Area

From \ To	Cm^2	m^2	Km^2	in^2	ft^2	S mi^2	nmi^2
Cm^2	1	0.0001	1×10^{-10}	0.1550	0.0011	3.86×10^{-11}	5.11×10^{-11}
m^2	10,000	1	1×10^{-6}	1550	10.76	3.86×10^{-7}	5.11×10^{-7}
Km^2	1×10^{10}	1×10^{6}	1	1.55×10^{9}	1.08×10^{7}	0.3861	0.2914
in^2	6.452	0.0006	6.45×10^{-10}	1	0.0069	2.49×10^{-10}	1.88×10^{-10}
ft^2	929.0	0.0929	9.29×10^{-8}	144	1	3.59×10^{-8}	2.71×10^{-8}
S mi^2	2.59×10^{10}	2.59×10^{6}	2.590	4.01×10^{9}	2.79×10^{7}	1	0.7548
nmi^2	3.43×10^{10}	3.43×10^{6}	3.432	5.31×10^{9}	3.70×10^{7}	1.325	1

Volume

From \ To	Cm^3	Liter	m^3	in^3	ft^3	yd^3	fl oz	fl pt	fl qt	gal
Cm^3	1	0.001	1×10^{-6}	0.0610	3.53×10^{-5}	1.31×10^{-6}	0.0338	0.0021	0.0010	0.0002
liter	1000	1	0.001	61.02	0.0353	0.0013	33.81	2.113	1.057	0.2642
m^2	1×10^{6}	1000	1	61,000	35.31	1.308	33,800	2113	1057	264.2
in^3	16.39	0.0163	1.64×10^{-5}	1	0.0006	2.14×10^{-5}	0.5541	0.0346	2113	0.0043
ft^3	28,300	28.32	0.0283	1728	1	0.0370	957.5	59.84	0.0173	7.481
yd^3	765,000	764.5	0.7646	46700	27	1	25900	1616	807.9	202.0
fl oz	29.57	0.2957	2.96×10^{-5}	1.805	0.0010	3.87×10^{-5}	1	0.0625	0.0312	0.0078
fl pt	473.2	0.4732	0.0005	28.88	0.0167	0.0006	16	1	0.5000	0.1250
fl qt	946.3	0.9463	0.0009	57.75	0.0334	0.0012	32	2	1	0.2500
gal	3785	3.785	0.0038	231.0	0.1337	0.0050	128	8	4	1

Mass

From \ To	g	Kg	oz	lb	ton
g	1	0.001	0.0353	0.0022	1.10×10^{-6}
Kg	1000	1	35.27	2.205	0.0011
oz	28.35	0.0283	1	0.0625	3.12×10^{-5}
lb	453.6	0.4536	16	1	0.0005
ton	907,000	907.2	32,000	2000	1

Temperature

$$^{\circ}C = 5/9\ (^{\circ}F - 32)$$

$$^{\circ}F = 9/5\ (^{\circ}C) + 32$$

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

LIST OF TABLES

I. INTRODUCTION

The use of certain Industrial Heating Devices (IHD) in manufacturing poses a possible problem to aeronautical navigation services if the IHD equipment operates on the same or close to the same frequencies as the aeronautical service, especially if the leakage RF is sufficiently strong. This report details an experiment that was conducted to measure actual RF fields radiated by two IHD devices operating in the 190-535 kHz frequency band. The experiments consisted of measurements based on FCC Part 18 and CISPR Publication 11 and 11A, in addition to absolute RF field measurements of emissions above the IHD units chosen. Two methods were used for the overhead measurements. The first consisted of using a tower to hoist the measurement antenna over the unit being tested, and recording RF fields for various azimuth angles relative to the IHD equipment. The second involved flying overhead the IHD unit with a calibrated antenna and receiver system on board a light aircraft.

The results of these experiments are presented in this paper. The IHD equipment measurements were made at the Elite Electronic Engineering open field test facility in Waterman, Illinois, in October of 1983 [1].

II. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions.

The RF fields radiated by two IHD devices were well below the FCC allowable levels as stated in Volume II, Part 18, Subpart J, regarding ISM equipment. The radiated levels with respect to the CISPR limits are well above allowable levels. There did not appear to be a significant difference in the measured RF levels between the ground and Clark tower data. There did seem to be a small amount of lobing, both horizontally and vertically. These observations may be due to the near-field effects.

Due to the low levels of RF energy launched by the IHD equipment, there were no fields measured by the airborne equipment. The measured noise level in the area of the tests for the airborne tests was approximately 1000 μV/m in the 425 - 495 kHz range.

When comparing the ground data and the Clark tower data the effects of the decay factor can be ignored. Since one of the goals of this paper is to report the difference in the ground measurement and the measurements made at higher elevation angles, the effects of the decay constant cancel out.

B. Recommendations.

There are several recommendations that can be made with regard to future measurements of this type which are listed below.

1. For making future measurements the aircraft should be equipped with a standard H-field loop antenna and a frequency selective receiver or spectrum analyzer capable of interfacing with a computer. This will provide the ability to change the measurement bandwidth rapidly, to optimize the receiver characteristics.

2. When making ground measurements to determine the decay factor, a large number of points needs to be taken into consideration in order to evaluate the characteristics of the decay factor. Additionally, an analytical curve fit should be used to assure that the best estimate of the decay factor is determined.

3. Before making the airborne measurement, an evaluation of the ambient noise environment at the measurement frequencies should be made. This will allow an evaluation of the aircraft generated noise to determine if it will corrupt the measurement data. The use of the spectrum analyzer can assist both in location of the noise and determination of the necessary measurement bandwidth characteristics to better isolate the signal from the noise.

4. If it is expected that a device is necessary to hoist an antenna to measure the RF fields over the equipment, it is suggested that a cherry-picker device similar to that used by utilities for power line repair be used. The calibrated antenna could be placed on a

10 foot pole attached to the cherry-picker bucket and hoisted to virtually any position in a hemisphere of approximately 60 foot radius.

III. GROUND RF MEASUREMENTS

The ground RF measurements were performed as per Federal Communications Commission's Rules and Regulations, Volume II, Part 18, Subpart D for Industrial Heaters, dated July 1981. The tests were performed at the Elite Electronic Engineering Company open field test facility in Waterman, Illinois (EQU/6810 4-3-0). All ground radiated emissions were measured with an HP 8568 Spectrum Analyzer using an HP 9825 computer as the controller. This system automatically commands the spectrum analyzer to perform the measurements, process and print out the data. The IHD unit was placed on a rotating table with the measurement antenna placed a known distance from the center of the table. The radiated measurements were then made at azimuth increments of 20 degrees. All measurements were made with 230 vac. 60 Hz applied to the IHD as input power while heating a water cooled load in a continuous operation. The radiated measurements were all made using loop antennas at the fundamental and up to the 10th harmonic. The frequency of interest for this report is the fundamental because it can exist as a co-channel interference source for the non-directional beacon aeronautical service.

The two IHD devices tested will be identified as Machine A and Machine B which are 3 kW and 15 kW output RF power devices, respectively. Since it is not the intent of this report to identify the IHD device tested in this study directly, the units will be referred to as described above.

FCC Rules and Regulations specify that measurements of radiated fields be related to measurements at a distance of one mile. If field measurements cannot be made at one mile range, then an extrapolation to one mile can be made based on a measured propagation decay factor. Extrapolation of an E-field measured at a distance D to an equivalent field at one mile is given by the following equation:

$$E_2 = E_1 \left[\frac{5280}{D} \right]^{-n}$$

where: E_2 = equivalent field at one mile in μV/m.

E_1 = measured field at distance D in μV/m.

D = measurement distance in feet.

n = propagation decay factor.

The propagation decay factor at IHD frequencies was measured by transmitting a uniform field from a loop antenna and measuring this field at various distances from the source using a calibrated loop. The measurements of E-field vs. distance were then plotted and a line drawn through the points. The slope of this line was taken as the propagation decay factor. This procedure was used by Elite Electronic Engineering Company (under subcontract) at Waterman, Illinois, to determine the propagation decay factor. The propagation decay factor measured at Waterman, Illinois at 425 kHz was 1.95 (Figure 1) and the decay factor measured at 495 kHz was 2.45 (Figure 2).

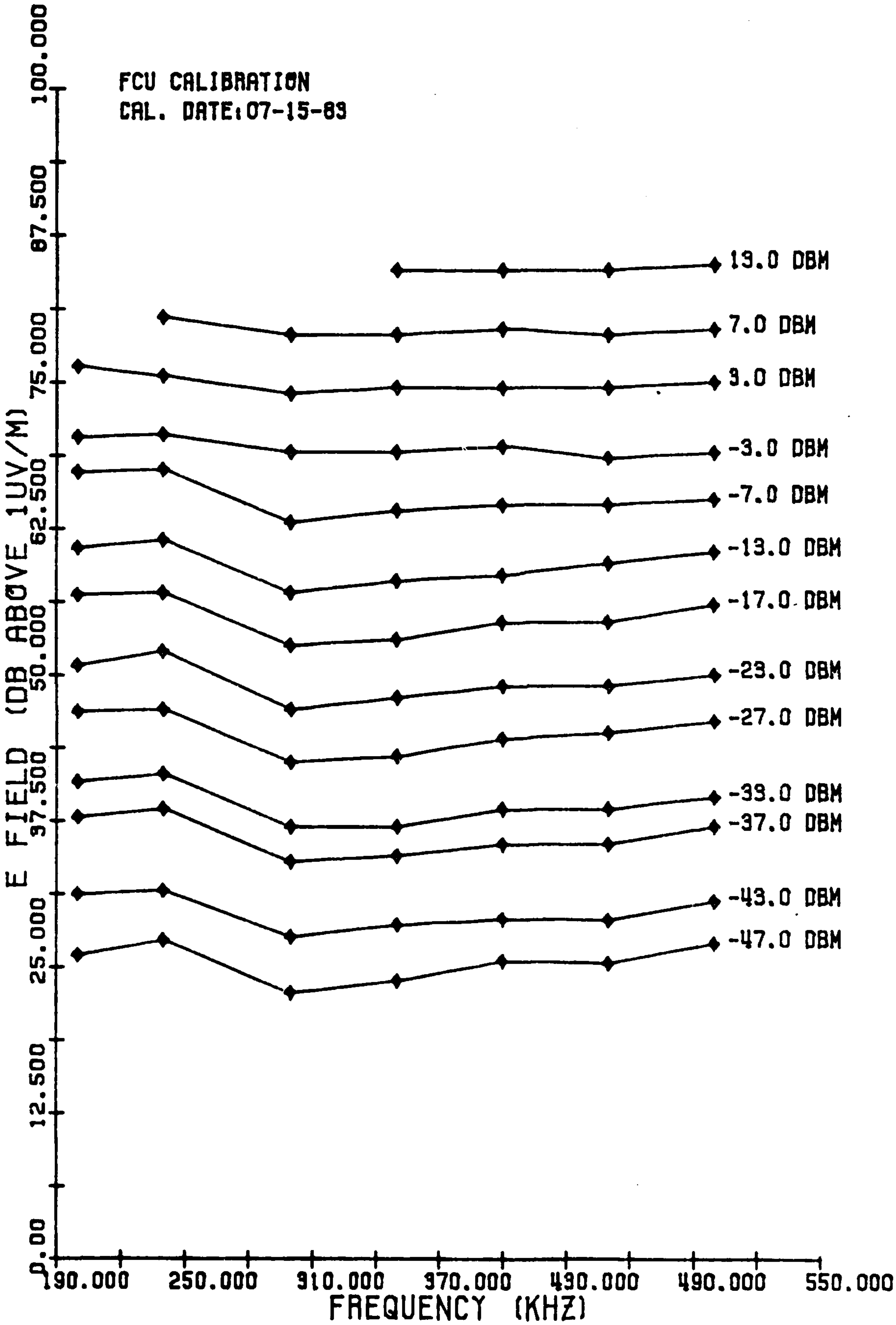

FIGURE 9. FIELD CALIBRATION UNIT (FCU) CALIBRATION CURVES.

V. AIRBORNE RADIATED FIELD MEASUREMENTS

To make the airborne measurements of the radiated fields from machines A and B a Piper Saratoga aircraft owned by Ohio University was used. This aircraft was instrumented with an ADF receiver that was calibrated by a proven method (see Appendix C) [4, 5]. This method involves calibrating a field calibration unit (FCU) using a calibrated receiver (in this case an Electrometrics EMC-25 and an ALR-25 H-field loop antenna). Figure 9 is a calibration plot that was derived from this calibration of the FCU. Referring to the plot each value in dBm next to each curve was the RF output level of the signal generator used to drive the FCU. Therefore, each curve represents the RF field produced at each frequency for a given input signal level from the RF generator driving the FCU.

The aircraft was equipped with an ADF receiver that was modified to provide AGC voltage as an output. An analog-to-digital converter was used to accept the AGC voltage and transmit it to a computer on board the aircraft to record the digitized AGC voltage. Previous to making the RF measurement flights, the FCU was used to calibrate the ADF receiver in the aircraft. The results of this calibration are indicated in Figures 10 to 16 which are the curves for 200 kHz to 500 kHz. These plots represent the correlation between the ADF AGC voltage and the radiated fields received at the aircraft position during the flight measurements.

The aircraft position was determined during the measurements using a Loran-C receiver. The output position along with the ADF-measured AGC voltage were recorded during the flight using the computer data acquisition system [6]. The aircraft was flown at an altitude of 500 ft. above the IHD equipment operating on the turntable at the open field site. The aircraft flew a constant north-south pass over the equipment with the Loran-C receiver in the aircraft recording the position. The device under test was rotated by the turntable to the appropriate azimuth for the measurement. The results of those flights are given in the plots of Figures 17 and 18. These plots indicate the radiated field strength as a function of the horizontal distance from the IHD unit under test. The plots also indicate the limits of the FCC and CISPR allowable emissions. The plots of Figure 17 and 18 are essentially plots of the local noise levels in the area at the time of the measurements. No detectable IHD radiation was observed in the aircraft during the test. The sensitivity of the ADF receiver used in the tests is approximately 27 dBμV/m. The results of the airborne tests are consistent with the measurements made by the Clark tower tests. The maximum radiated field strength measured by the Clark tower for either Machine A or B is 202 μV/m at an extrapolated distance of 1000 ft. This field converted to 500 feet (the altitude of the aircraft over the IHD) is 780 μV/m which is equivalent to 58 dBμV/m. Since the local noise level during the tests was about the same or slightly higher, the emissions were not detectable from the aircraft. The flight measurements were made with the azimuth of the IHD device oriented so that the direction of flight was along the ground-measured lobe of maximum radiation.

at higher elevation angles. This indicates that the 15 kW machine produced more radiation in the horizontal direction than in the vertical direction. The Clark tower measured field strength along the direction of maximum radiation (300°) was 11.7 μV/m, whereas the ground measurements produced a field of 30 μV/m. The following table indicates the maximum field strength values for the two machines compared.

MACHINE A 3 kW 425 kHz

Ground	Clark Tower
1000 ft.	@ 1000 ft.
340°	@ 340°
Elev. Ang. = 0°	Elev. Ang. = 74°
100 μV/m	196 μV/m

FCC Limit (1000 ft., decay factor = 1.95) = 257 μV/m
CISPR Limit (1000 ft., decay factor = 1.95) = 28 μV/m

MACHINE B 15 kW 495 kHz

Ground	Clark Tower
1000 ft.	1000 ft.
300°	300°
Elev. Ang. = 0°	Elev. Ang. = 46°
30 μV/m	11.7 μV/m

FCC Limit (1000 ft., decay factor = 2.45) = 589 μV/m
CISPR Limit (1000 ft., decay factor = 2.45) = 3.3 μV/m

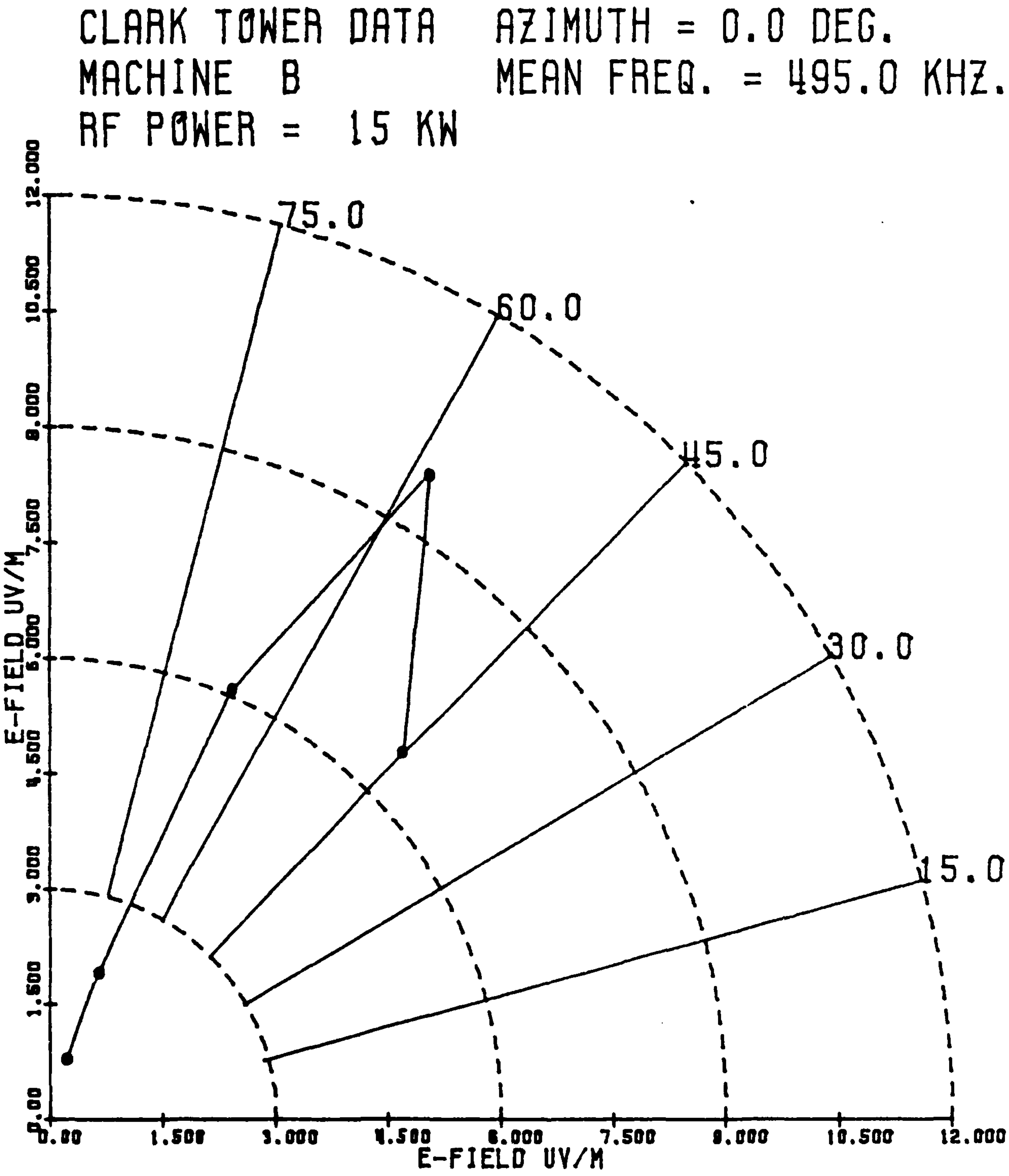

FIGURE 8. MACHINE B CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 0° AZIMUTH DECAY FACTOR = 2.45.

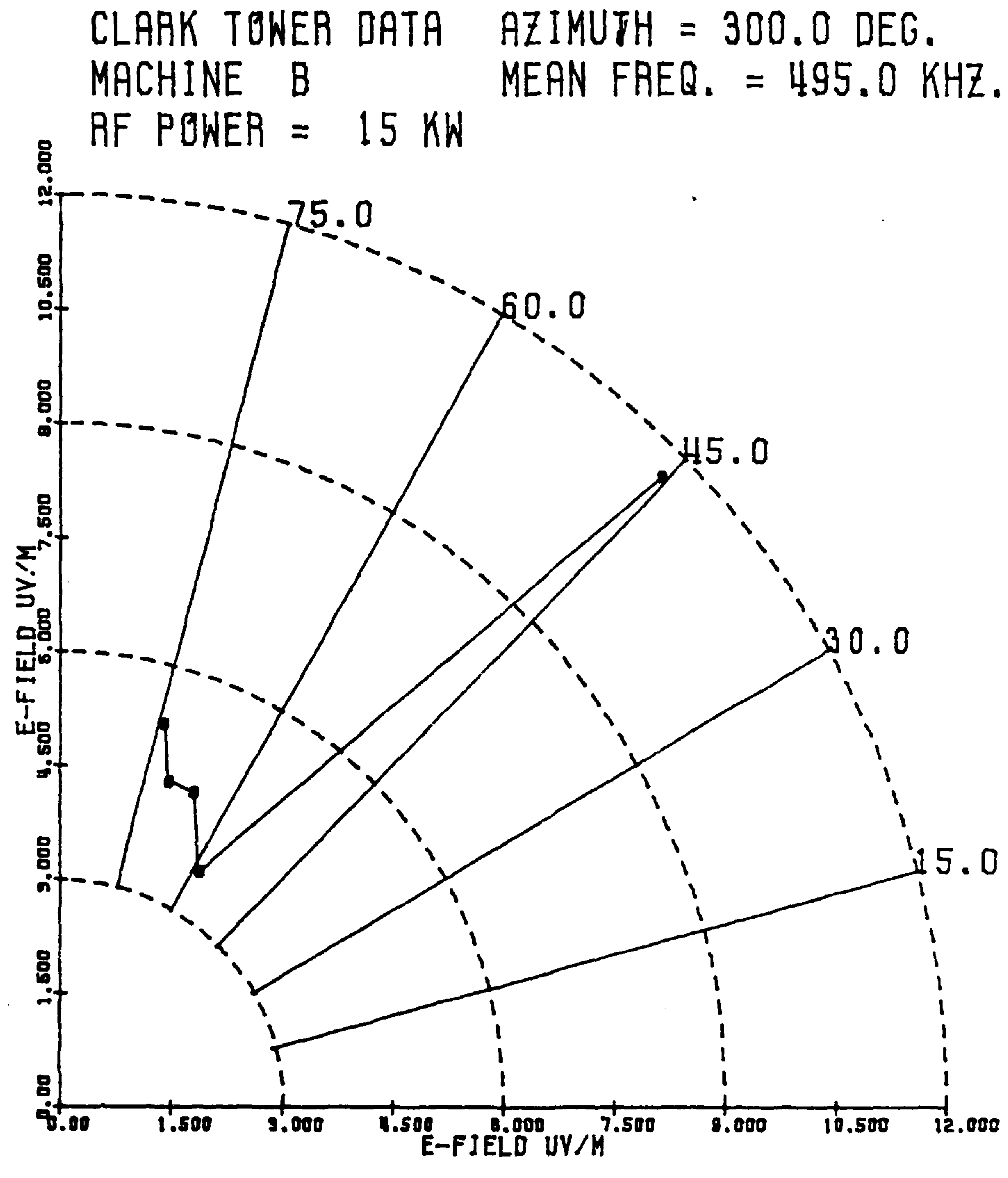

FIGURE 7. MACHINE B CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 300° AZIMUTH DECAY FACTOR = 2.45.

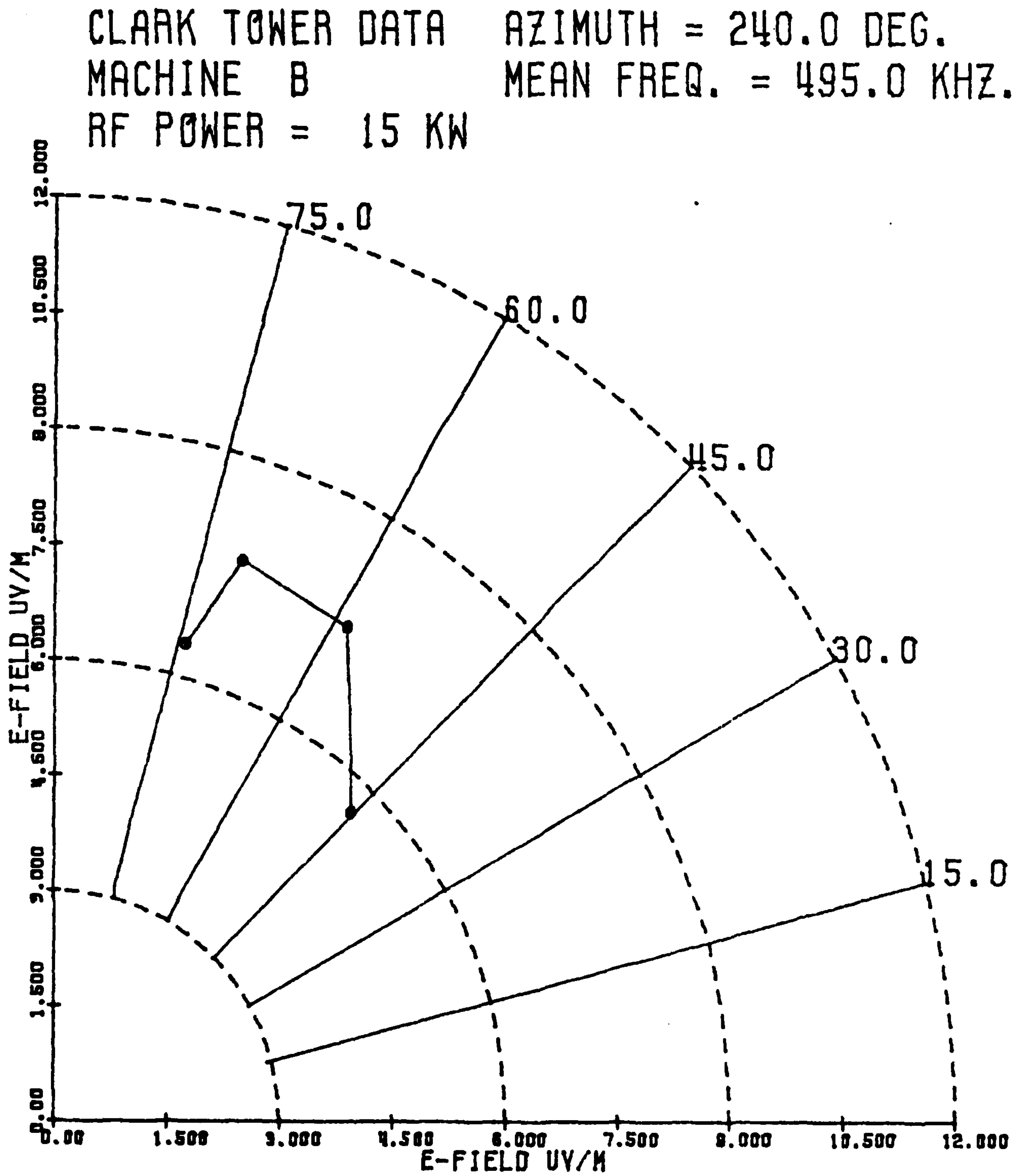

FIGURE 6. MACHINE B CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 240° AZIMUTH DECAY FACTOR = 2.45.

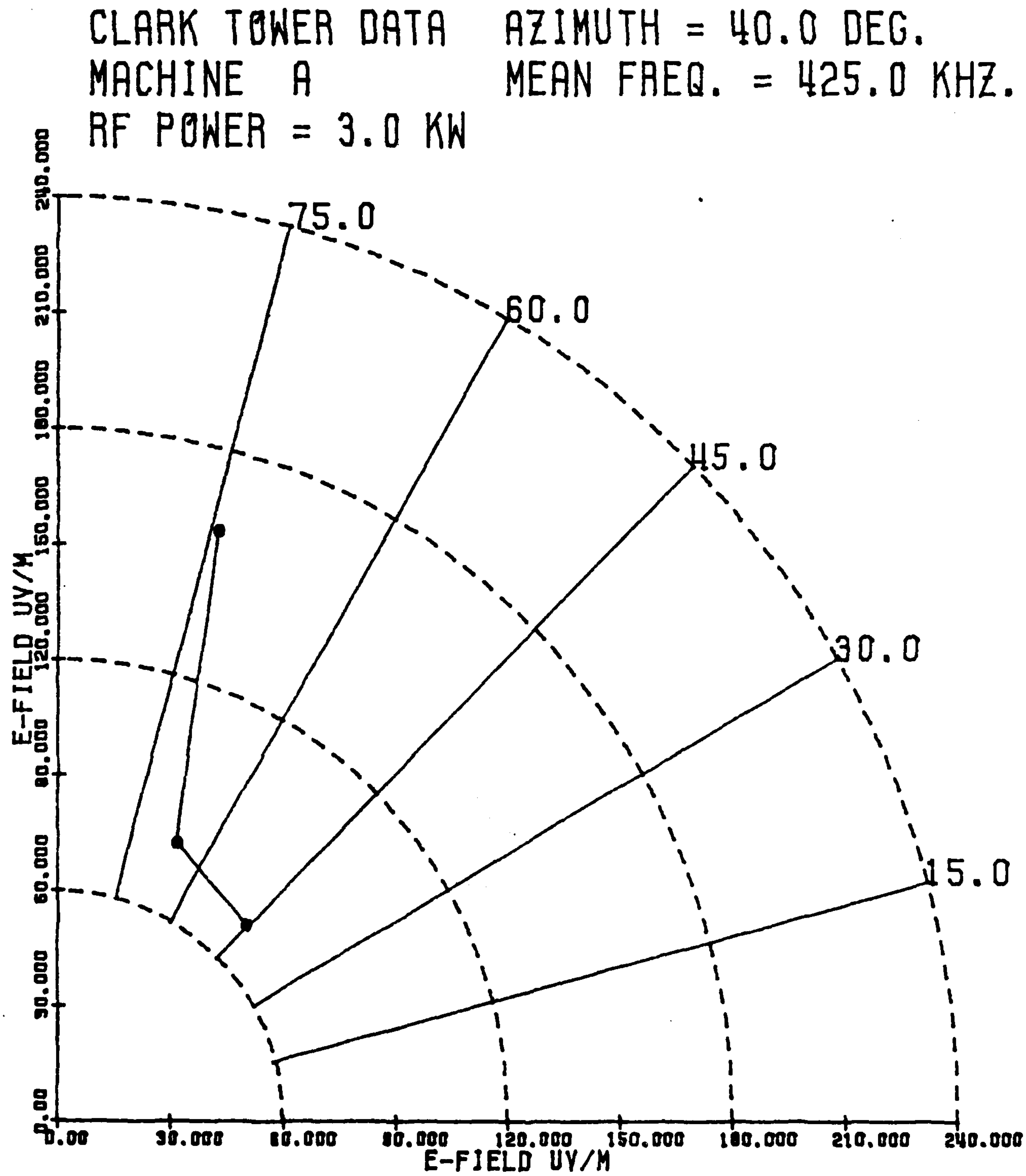

FIGURE 5. MACHINE A CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 40° AZIMUTH DECAY FACTOR = 1.95.

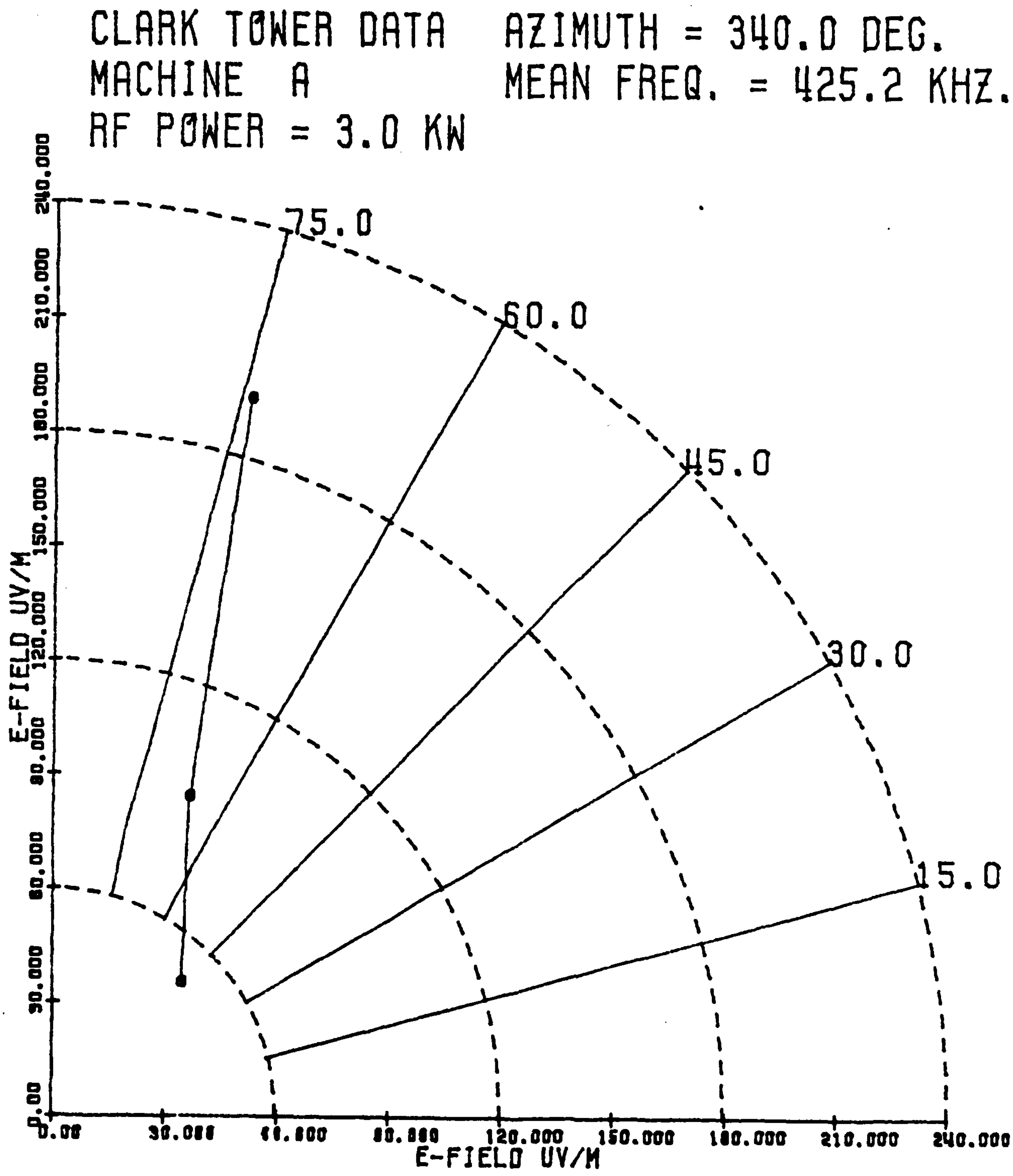

FIGURE 4. MACHINE A CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 340° AZIMUTH DECAY FACTOR = 1.95.

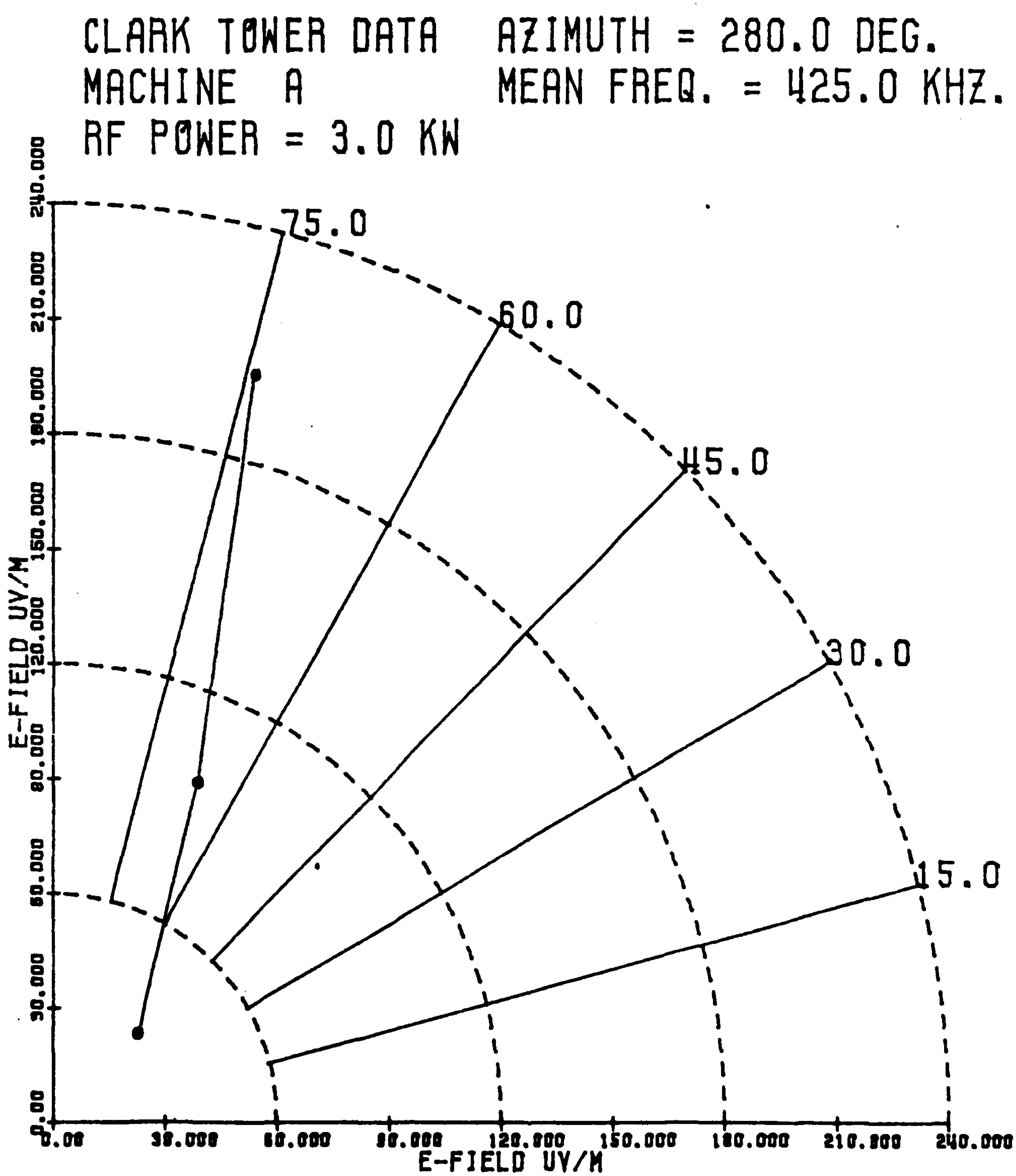

FIGURE 3. MACHINE A CLARK TOWER DATA NORMALIZED TO 1000 FEET AT 280° AZIMUTH DECAY FACTOR = 1.95.

IV. CLARK TOWER RF FIELD MEASUREMENTS

In order to get a better indication of the RF fields that existed above the IHD device, a Clark tower was used to hoist a loop antenna to sense the radiated fields at higher elevation angles. The Clark tower was positioned to the side of the turntable containing the IHD unit under test. The center of the tower was positioned 15.75 feet from the center of the turntable. The Clark tower was extended to a maximum height of 56 feet and lowered to a minimum height of 16 feet. This provided elevation angles from approximately 45 degrees to 75 degrees to the horizon.

The loop antenna and spectrum analyzer used for the ground measurements are the same as those used to make the Clark tower measurements. This equipment was provided by Elite Electronic Engineering Company.

The same equations used to determine the extrapolated field intensity in the ground measurements were repeated here. Plots of the Clark tower data are indicated in Figures 3 through 8 in which the fields were plotted normalized to 1000 feet. These plots indicate the radiated fields from the IHD unit located at the lower left corner of the plot.

In all of the plots for both Machine A and B the radiated fields remain within FCC limits of 10 μV/m at one mile even at higher elevation angles. One interesting observation was that the higher-output-power Machine B had lower radiated fields than the lower powered Machine A. This may be due to the additional attention given to the EMI shielding design for the higher power IHD unit.

To consider the Comite International Special Des Perturbations Radioelectriques (CISPR) radiated emissions limits, Machine A falls into the 0.285 to 0.49 MHz frequency range with a limit of 250 μV/m at a distance of 100 meters (328 ft.). Machine B, however, falls in the 0.49 to 1.605 MHz frequency range with a limit of 50 μV/m at 100 meter [3]. If the maximum values of the Machine A Clark tower plots are considered, the extrapolation of the fields from 1000 ft. to 328 ft. produces a radiated field of 1780 μV/m at 328 ft. (100 meters). This is significantly greater than the CISPR limit of 250 μV/m at 100 meters. Machine B, considered in the same way, evaluates to a radiated field intensity of 177 μV/m at 100 meters. The limit for Machine B is 50 μV/m at 100 meters so it also exceeds the CISPR radiated emissions limits.

Machine A and Machine B indicate different results when comparing the fields measured by the Clark tower and the ground tests. The Clark tower measurements were made along the azimuths determined by the ground tests to be the maximum radiation directions. The Machine A (the 3 kW IHD device) data indicated that the Clark tower data at higher elevations produced about 3 dB more radiation than the measurements made at ground level. This would tend to indicate that Machine A was radiating more energy upward than along the horizontal direction.

For Machine B (the 15 kW device) just the opposite was discovered. The measured fields along the ground were greater than the measured fields

MACHINE A
(See Figure 1)

Measured E-field at 50 ft.:	43,652	μV/m
Decay factor n_1 from line chose by Elite Electronics:	2.45	
Decay factor n_2 from line chosen by authors:	2.17	
E-field extrapolated to one mile using n_1:	0.5	μV/m
E-field extrapolated to one mile using n_2:	1.8	μV/m
FCC limit at one mile:	10	μV/m
Ground measurement, azimuth =	340	degrees

MACHINE B
(See Figure 2)

Measured E-field at 50 ft.:	34,674	μV/m
Decay Factor n_1 from line chosen by Elite Electronics:	1.95	
Decay Factor n_2 from line chosen by authors:	1.42	
E-field extrapolated to one mile using n_1:	3.9	μV/m
E-field extrapolated to one mile using n_2:	46	μV/m
FCC limit at one mile:	10	μV/m
Ground measurement, azimuth =	300	degrees

Table 1. Illustration of Effects of Decay Factor Measurement Accuracy.

Both Figures 1 and 2 use a straight line approximation to determine the decay factor, indicating a linear function. The experience of Elite Electronic Engineering's personnel indicates that the decay factor is indeed a linear function. The data indicate a possibility that this may be a non-linear function. However, there is insufficient data to support either claim fully.

The method used to determine the decay factor in this study is susceptible to error from several sources. The large difference between the decay factors measured at Waterman, Illinois, may be attributed to several factors: 1) atmospheric conditions were different for the two measurements, one measurement was taken in the morning following a rain storm, the relative humidity was high and the ground was wet, while the other measurement was taken later in the day after the weather had cleared; 2) frequencies were different for the two measurements; 3) the selection of the best way to determine the straight line curve and the selection of a sufficient number of data points are open for discussion. Other factors such as equipment placement could also have effects on the measurement. If the differences were caused by atmospheric conditions, frequency, or other natural phenomena then the results are valid and the difference truly exists. Most likely, the difference in the measurements was caused by a combination of all of the above.

The data in Table 1 are given to illustrate the importance of accurate decay factor measurement and the criticality of graphically choosing the best curve fit. Table 1 gives the field strengths extrapolated to one mile using different interpretations of the best curve fit for the decay factor measurement. For consistency, all field extrapolations in this report except those in Table 1 use the decay factors chosen by Elite Electronic Engineering Company.

A. Ground RF Test Results.

The results of the ground FCC testing indicated that both Machine A and Machine B met the allowable emissions limits described in Part 18, Subpart D for industrial heating devices. The maximum radiated RF field for Machine B is 3.9 μV/m at an azimuth of 300 degrees. Machine A had a maximum radiated field at 340 degrees of 0.5 μV/m at one mile. The data for these devices are given in Appendix A, which includes a plot of the radiated spectrum and a plot of the radiation pattern for each device.

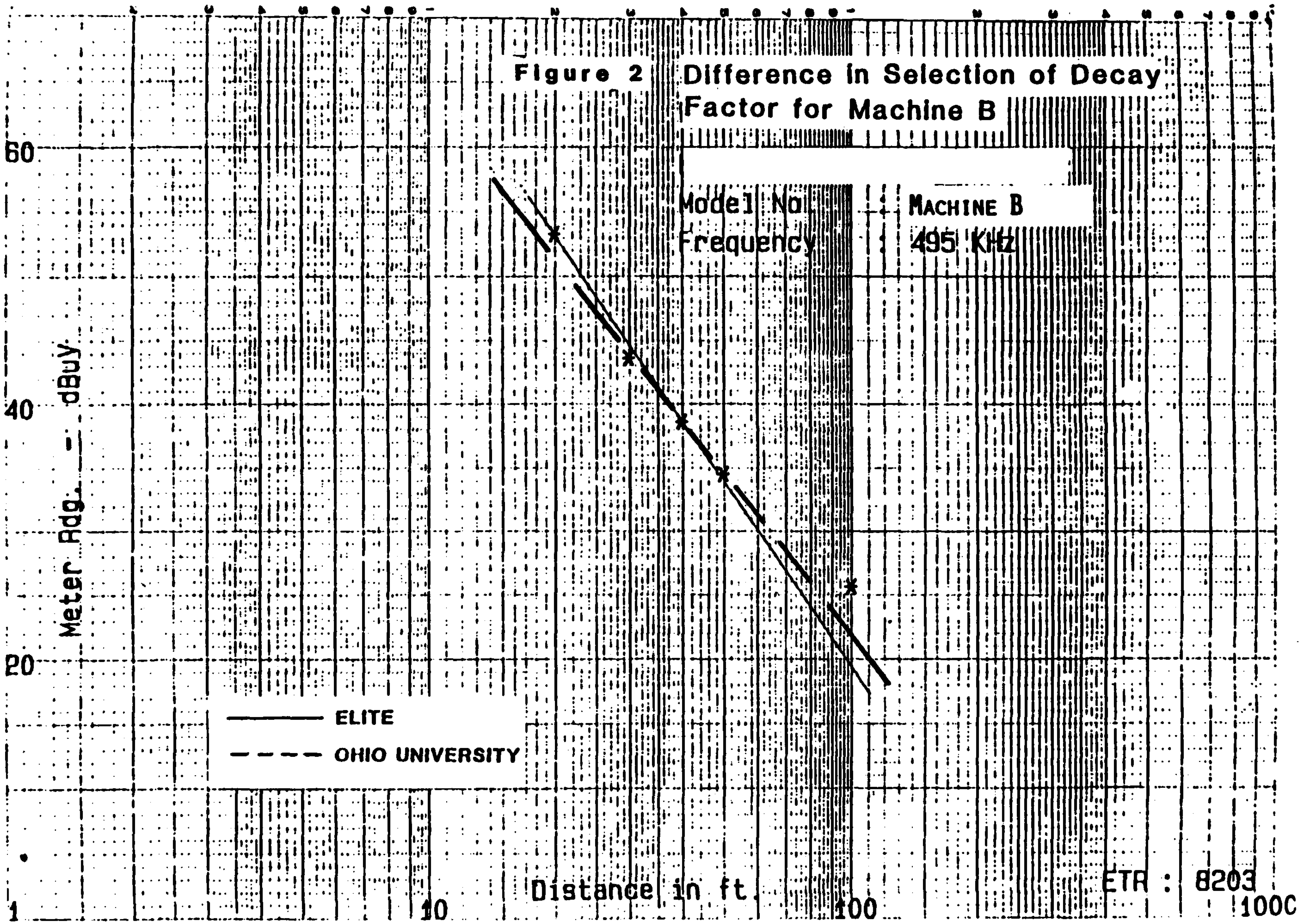

Figure 2 Difference in Selection of Decay Factor for Machine B

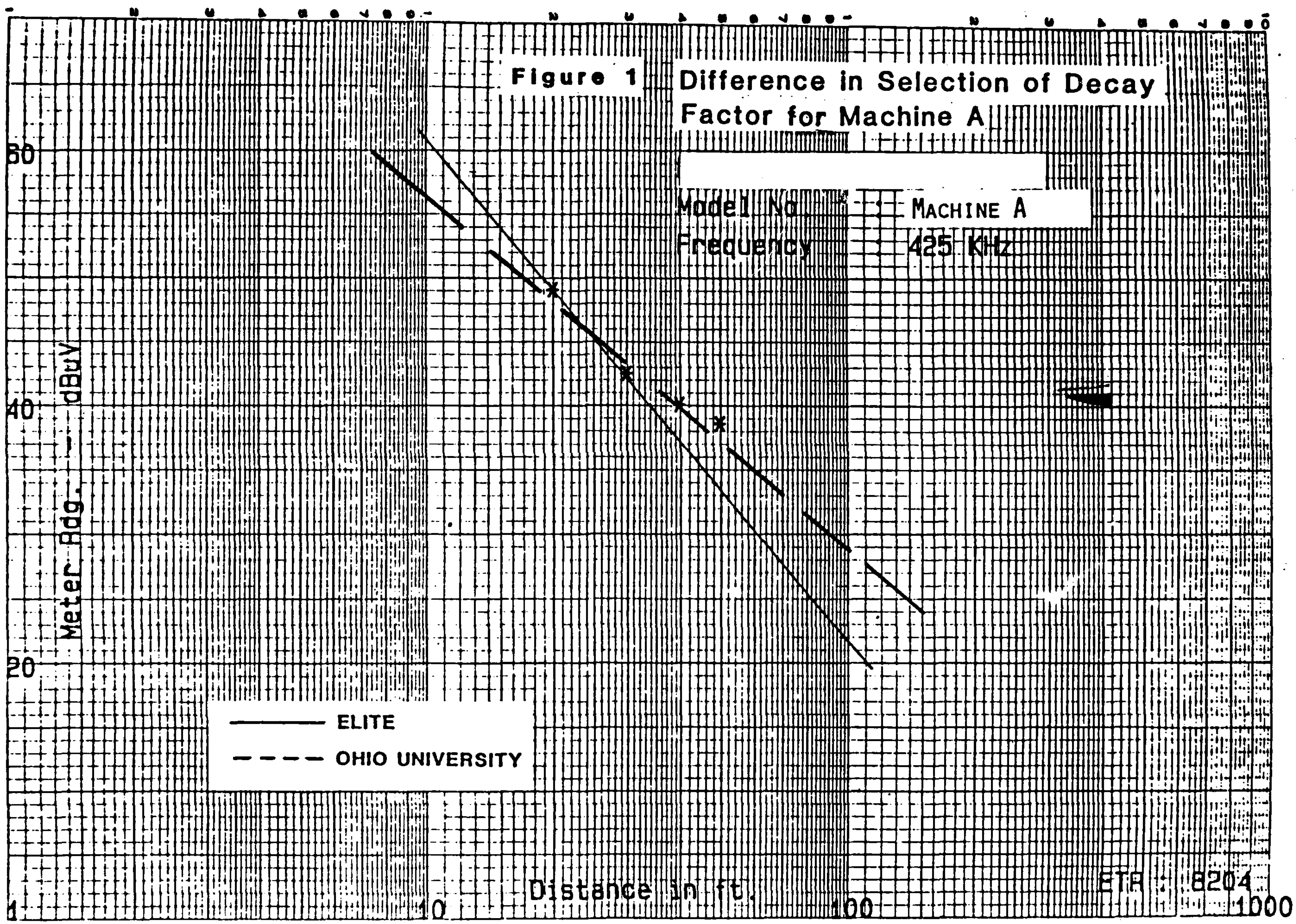

Figure 1
Difference in Selection of Decay Factor for Machine A
Model No. : MACHINE A
Frequency : 425 KHz
Meter Rdg. - dBuV
60
40
20
1
10
100
1000
Distance in ft.
ELITE
OHIO UNIVERSITY
ETR : 8204

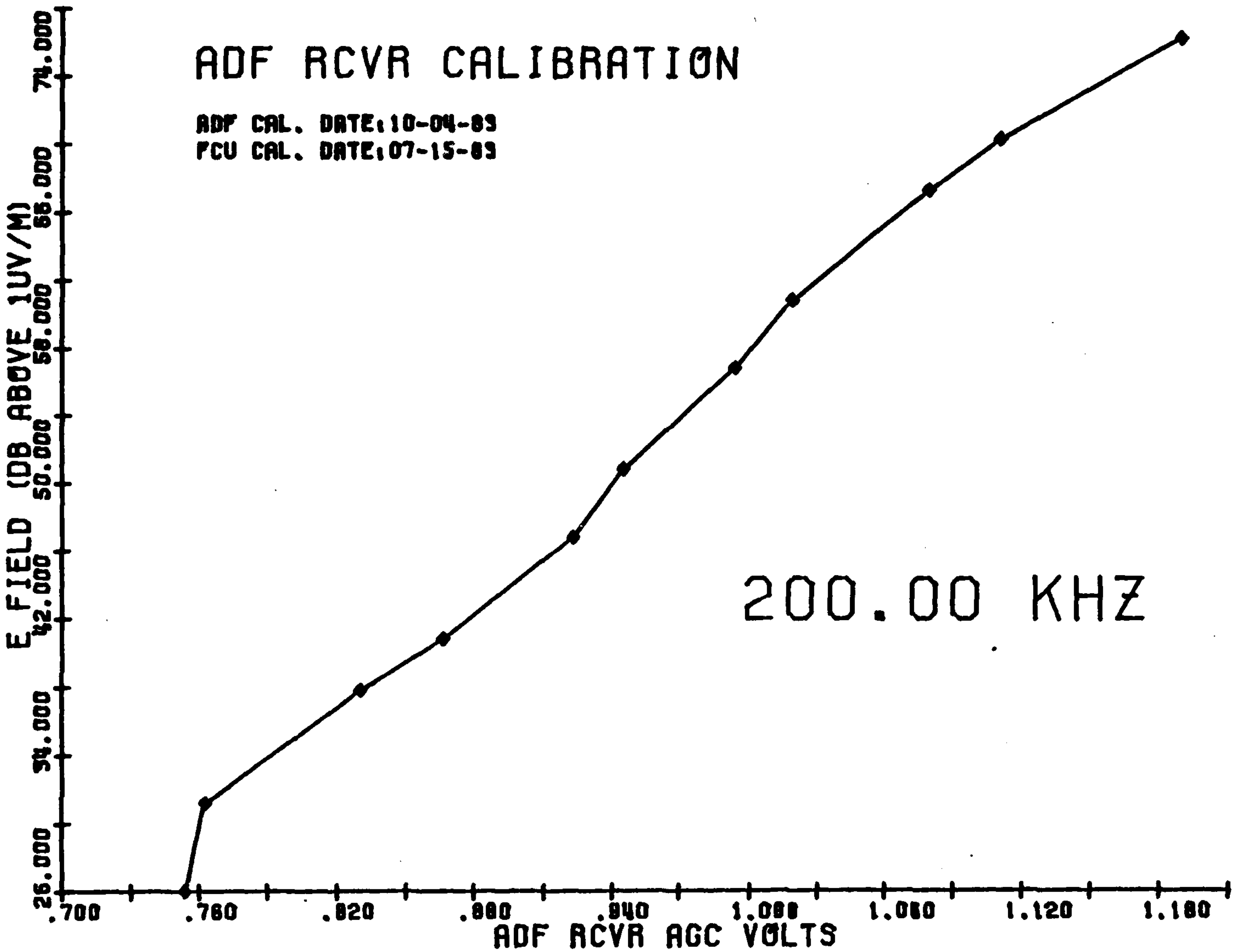

FIGURE 10. ADF RECEIVER CALIBRATION AT 200 KHZ.

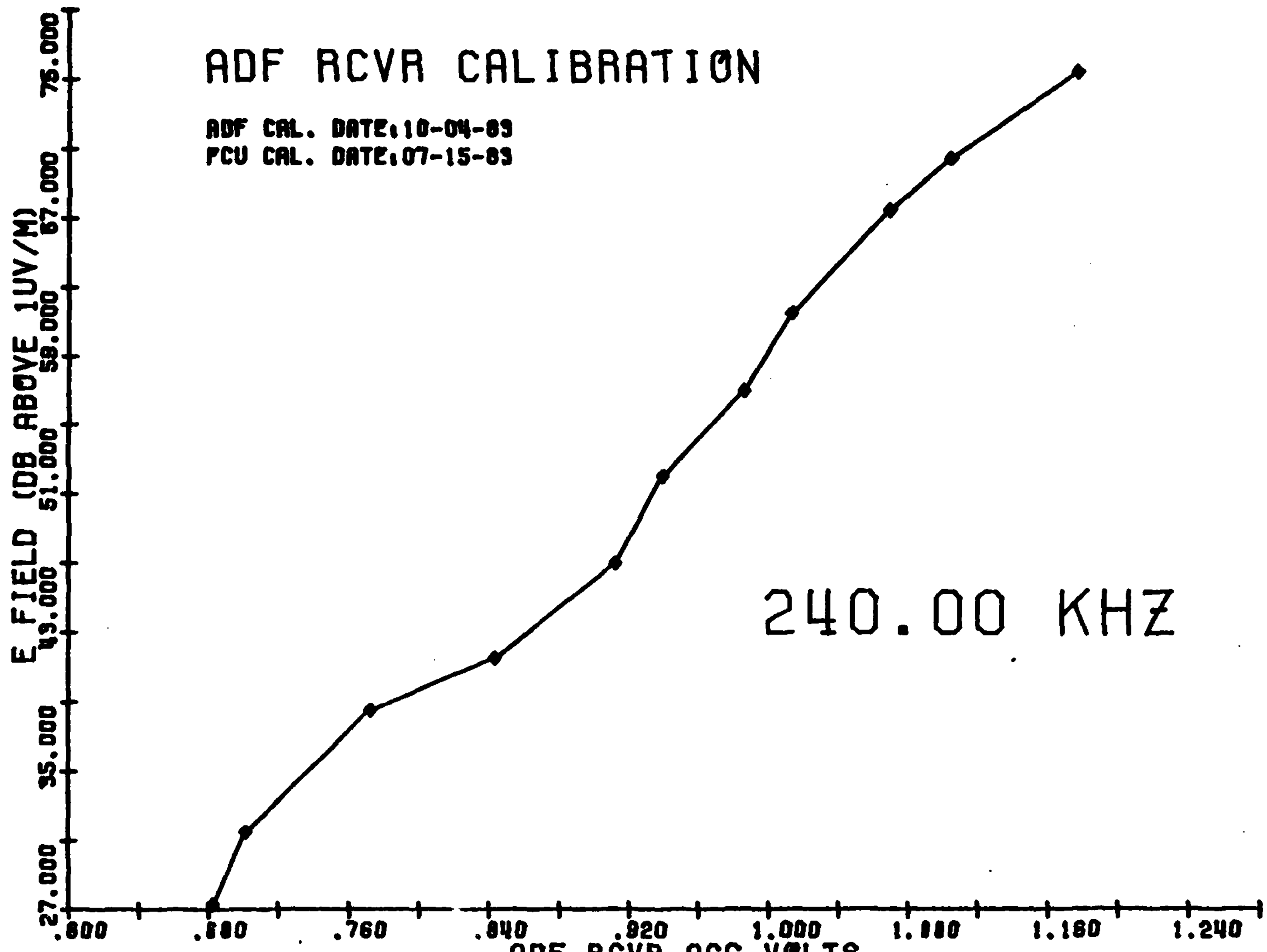

FIGURE 11. ADF RECEIVER CALIBRATION AT 240 KHZ.

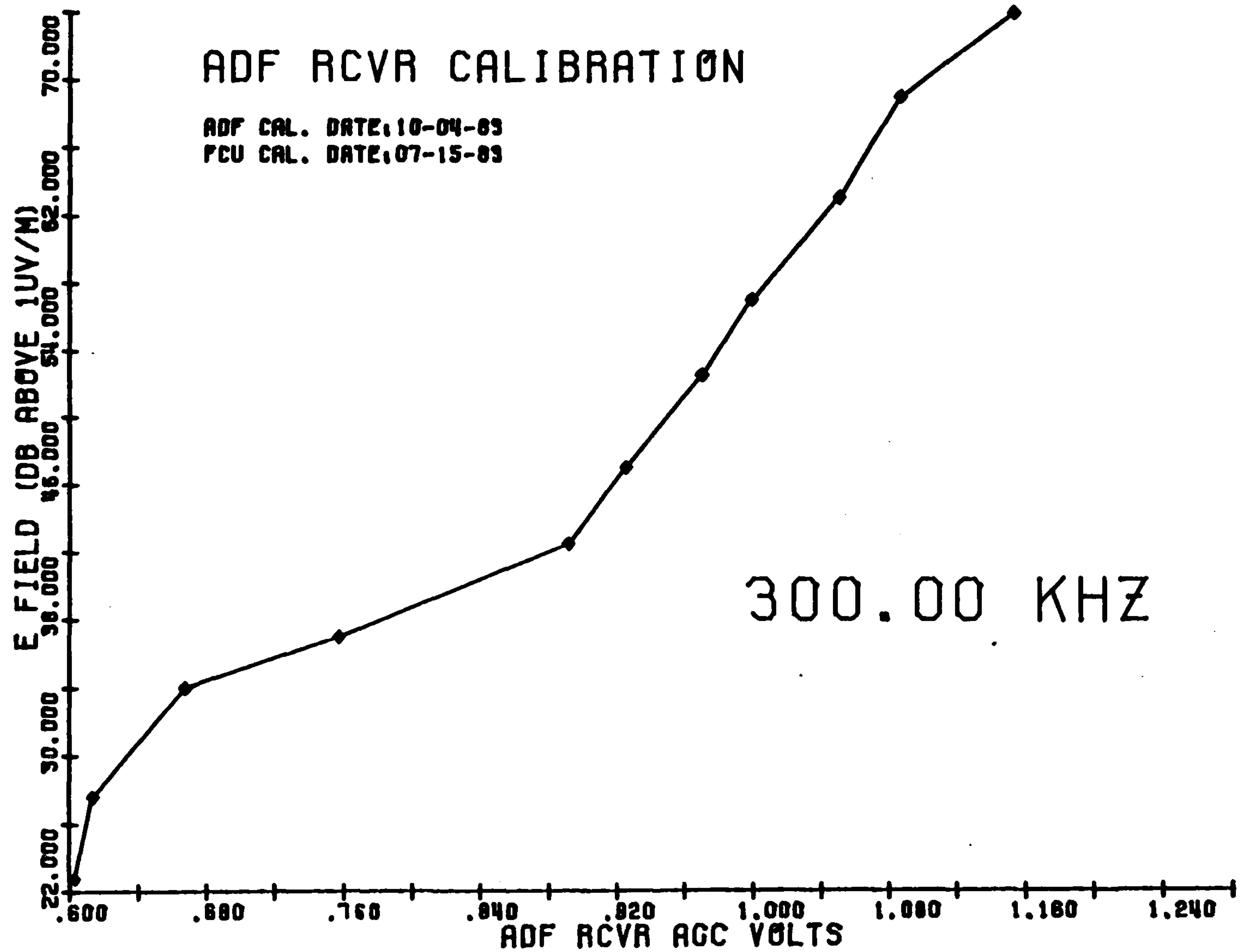

FIGURE 12. ADF RECEIVER CALIBRATION AT 300 KHZ.

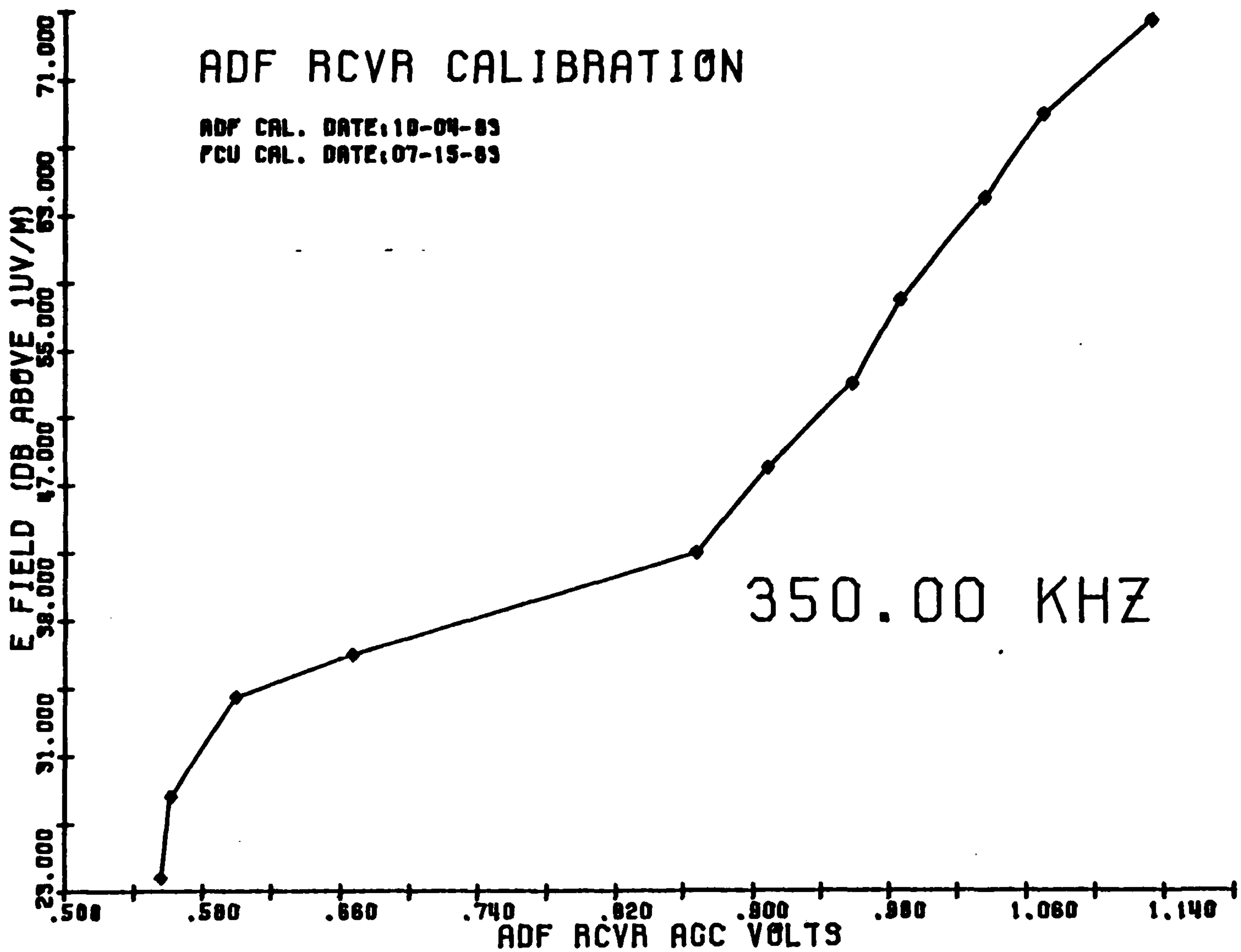

FIGURE 13. ADF RECEIVER CALIBRATION AT 350 KHZ.

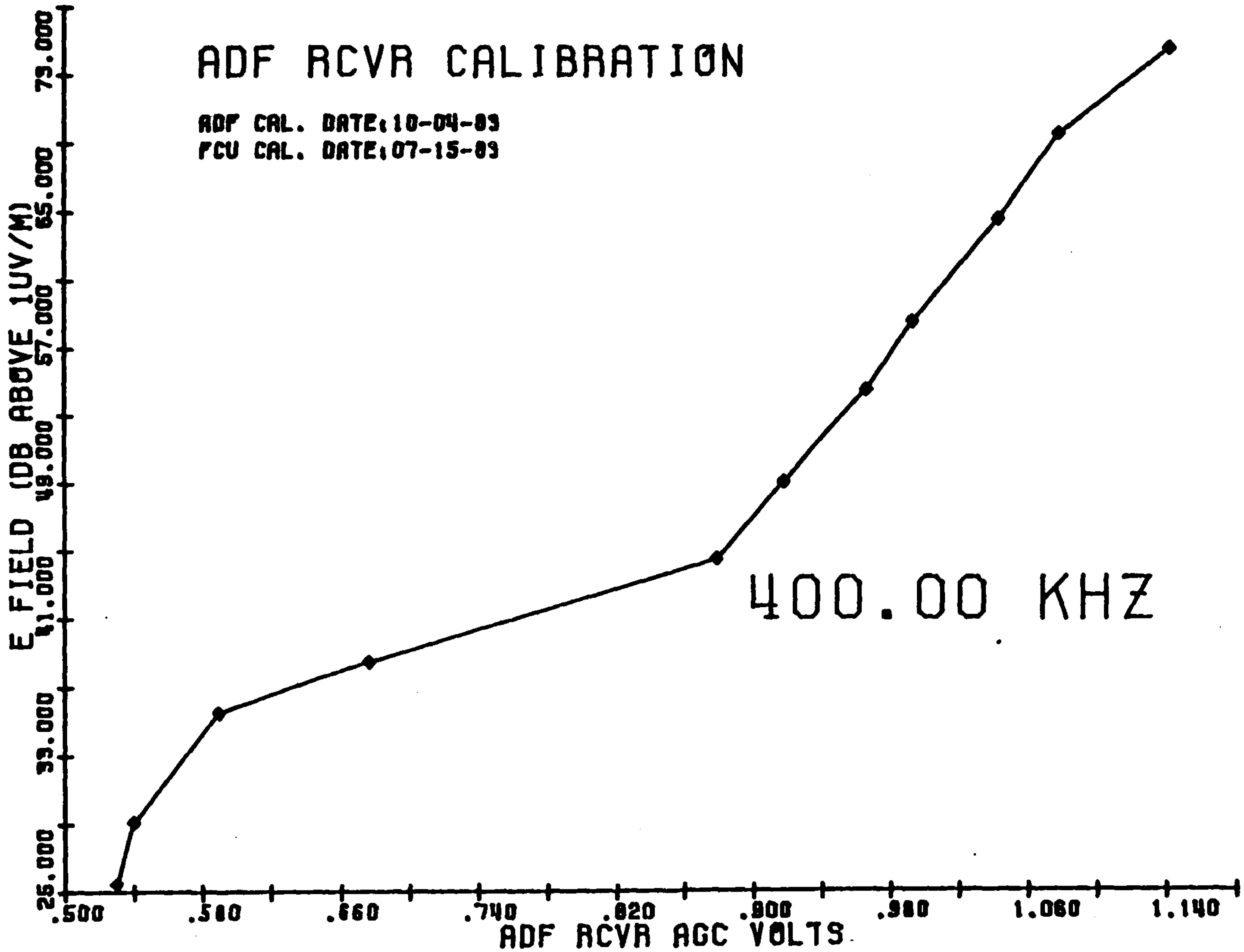

FIGURE 14. ADF RECEIVER CALIBRATION AT 400 KHZ.

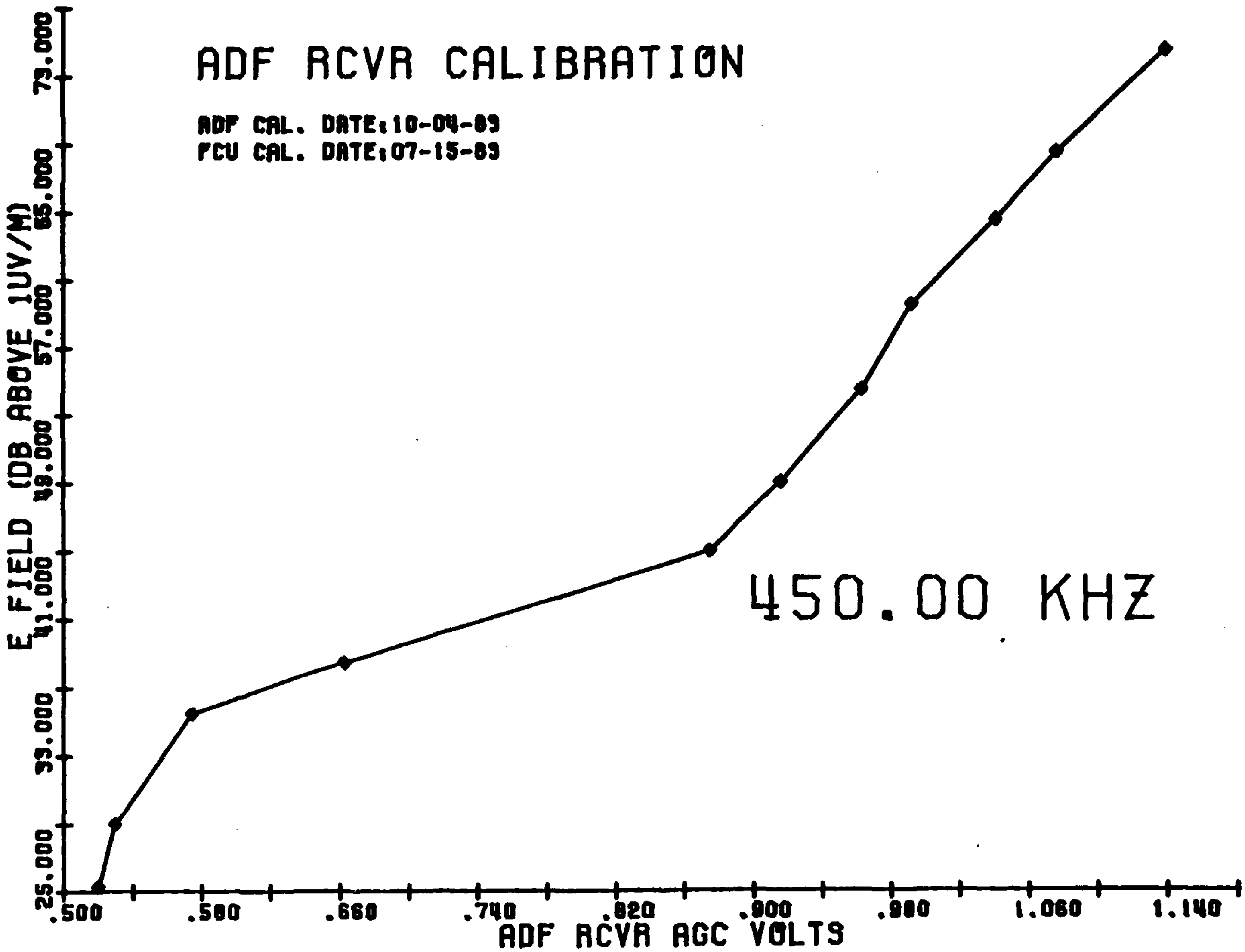

FIGURE 15. ADF RECEIVER CALIBRATION AT 450 KHZ.

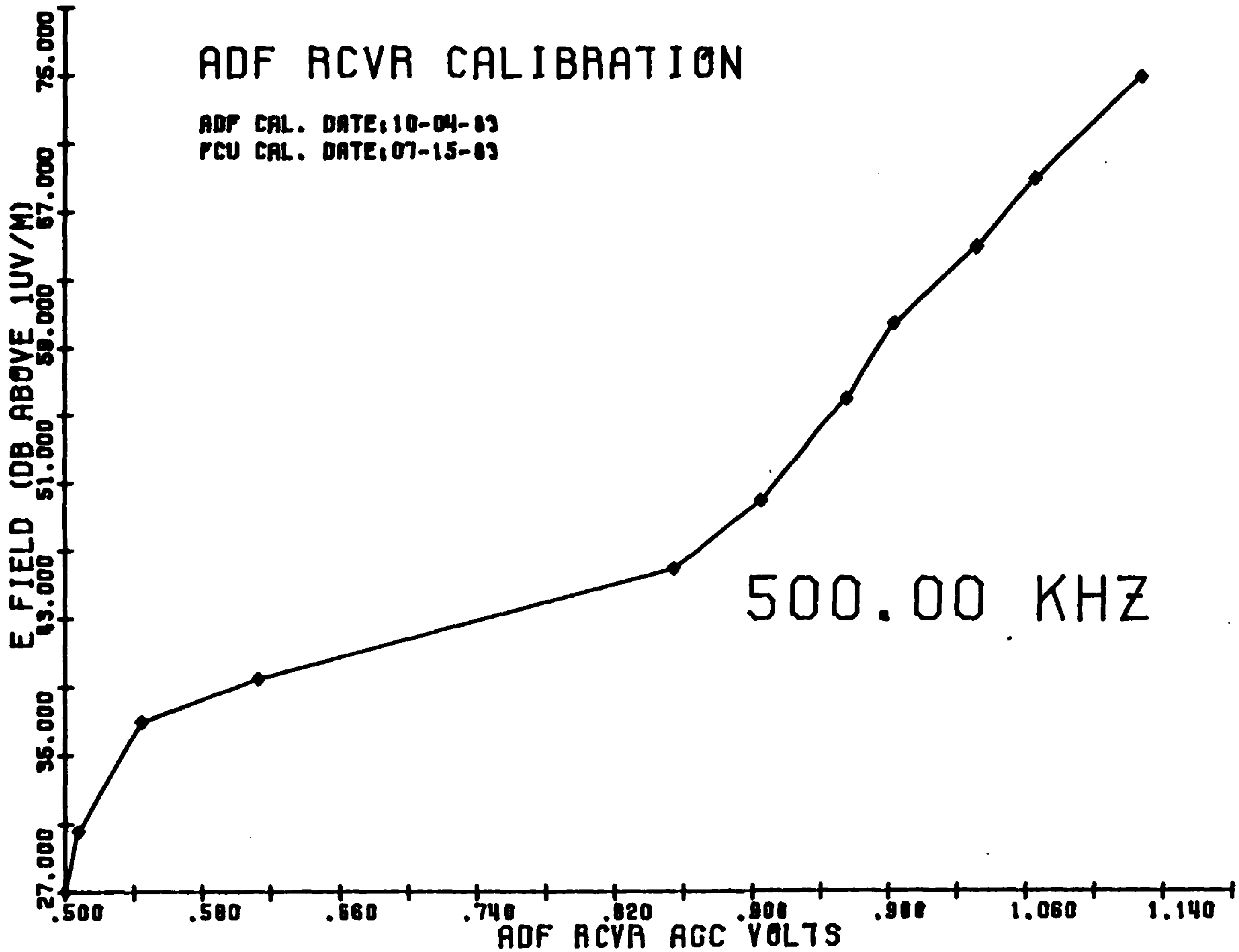

FIGURE 16. ADF RECEIVER CALIBRATION AT 500 KHZ.

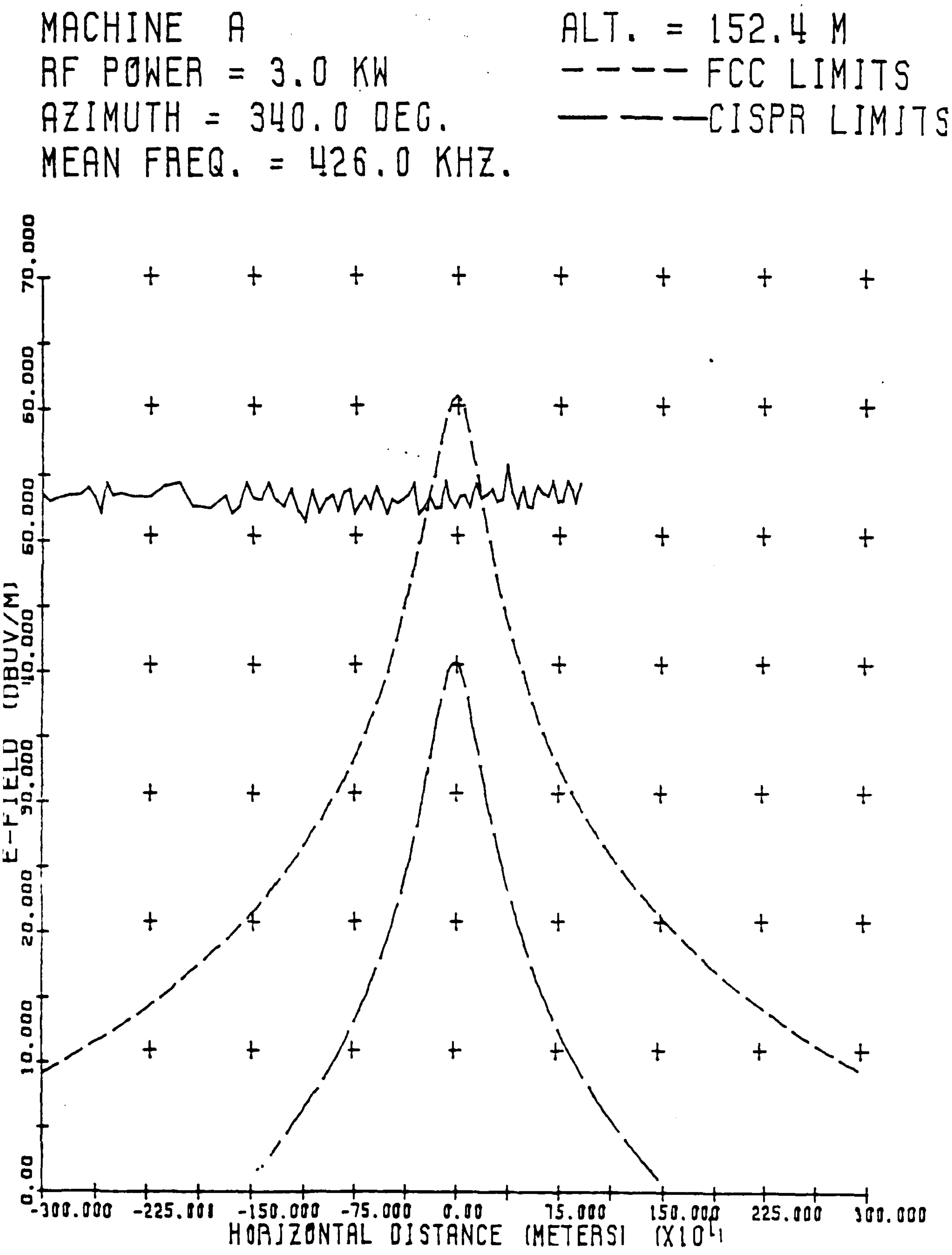

FIGURE 17. AIRBORNE IHD MEASUREMENTS MACHINE A.

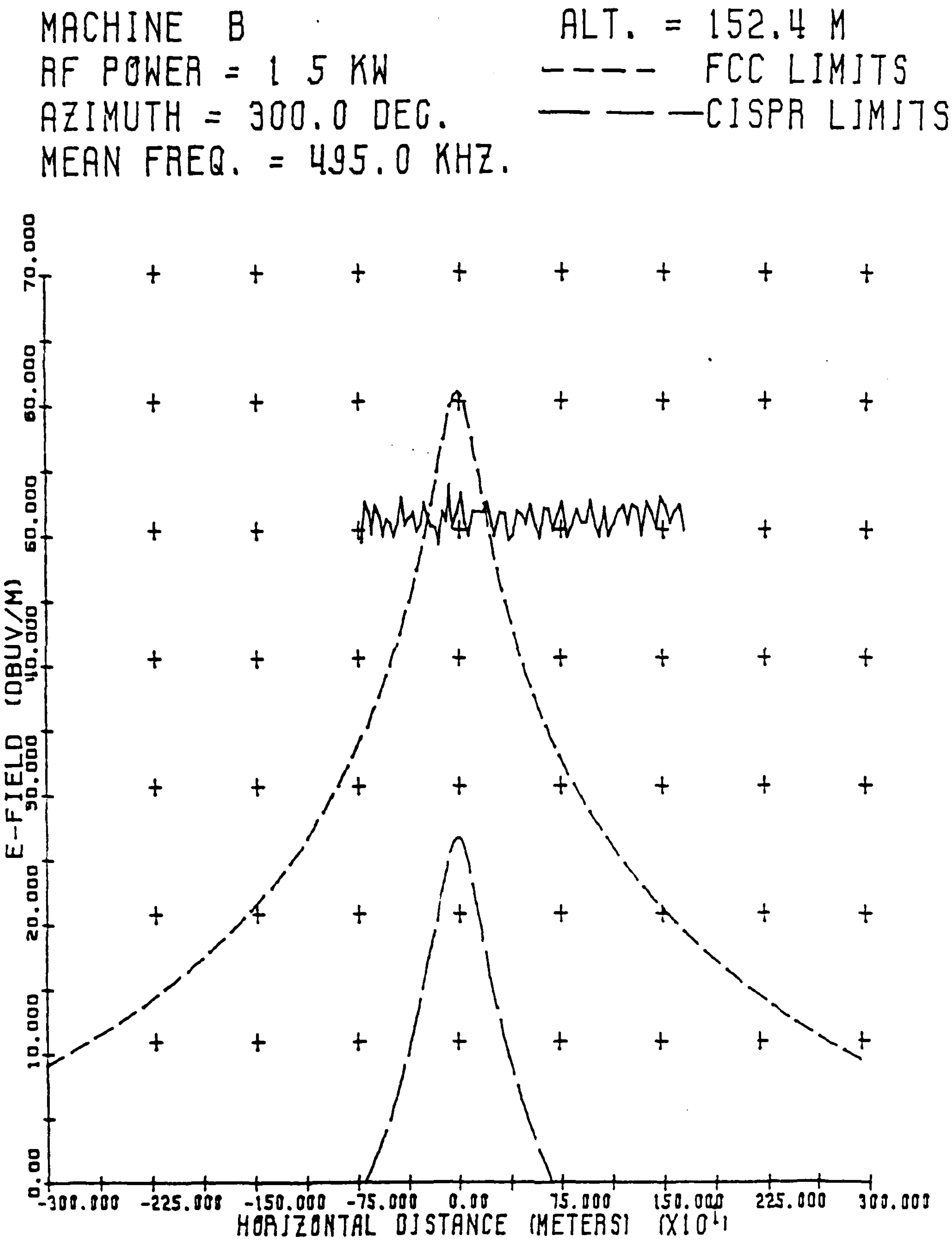

FIGURE 18. AIRBORNE IHD MEASUREMENTS MACHINE B.

VI. REFERENCES

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[2] Federal Communication Commission, Rules and Regulations, Volume II, Part 18, Industrial Scientific and Medical Equipment, Subpart D; July 1981.

[3] Comite International Special Des Perturbations Radioelectriques, International Special Committee on Radio Interference, Publication 11.

[4] Bash, Jerry L., "A Comparison of Measured and Theoretically Predicted Electric Field Strength for Radio Waves in the Frequency Range 200-500 kHz," Master's Thesis, Ohio University, Athens, Ohio; March 1980.

[5] Taggart, H.E., J.L. Workman, "Calibration Principles and Procedures for Field Strength Meters (30 Hz. to 1 GHz.)," NBS Technical Note 370; March 1969.

[6] Drury, William, "Data Collection and Recording System for IHD/ISM Measurements," Master's Thesis in progress, Ohio University, Athens, Ohio; 1985.

See also:

[7] Nickum, James D., "Measurement of RF Fields Associated with ISM Equipment as it Relates to Aeronautical Services," Avionics Engineering Center, Ohio University, DOT/FAA/ES-84/2; August 1984.

VII. APPENDIXES

A. Machine A Ground Test Data
B. Machine B Ground Test Data
C. ADF Calibration Procedure

MACHINE A GROUND TEST DATA

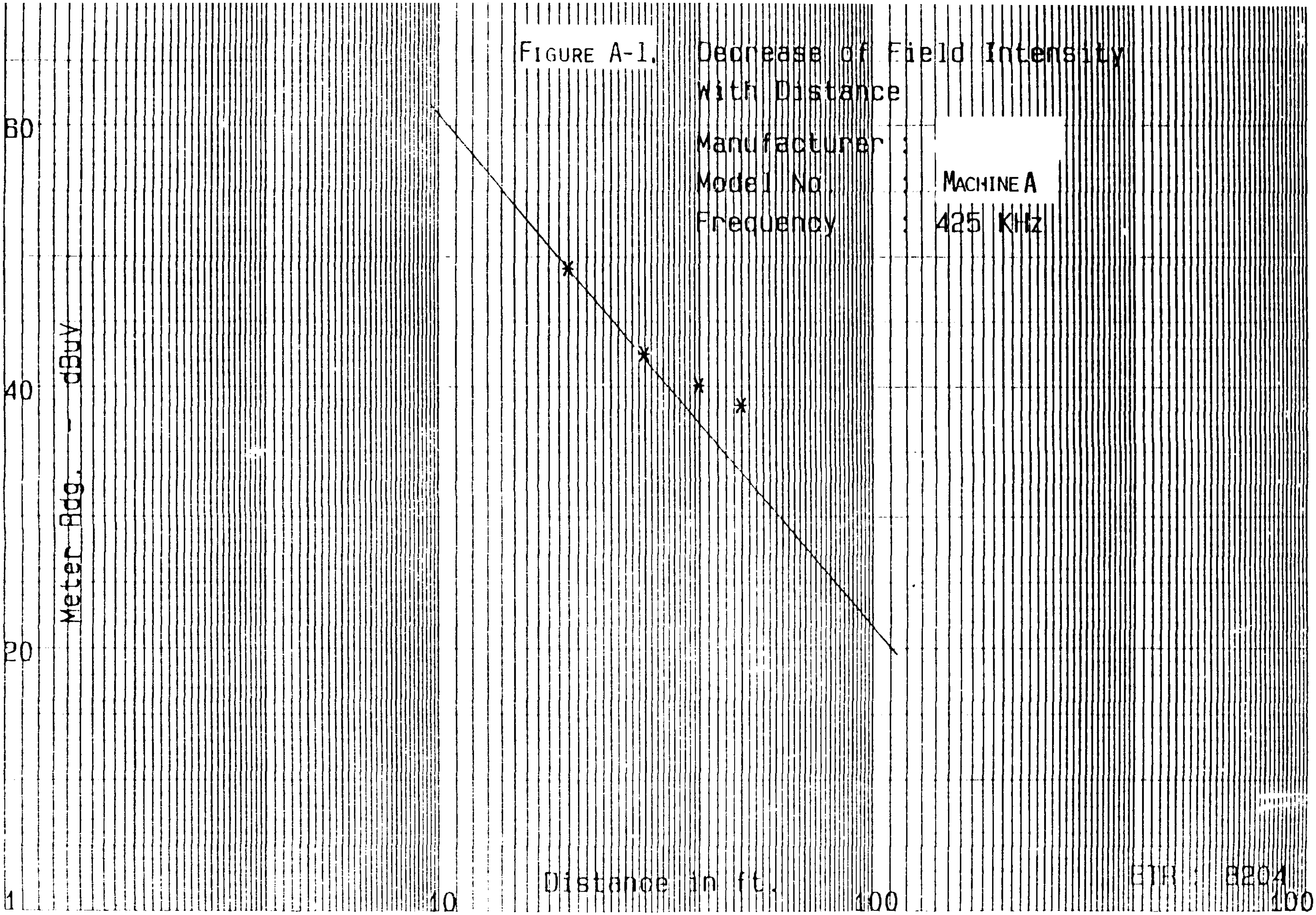

FIGURE A-1. Decrease of Field Intensity With Distance

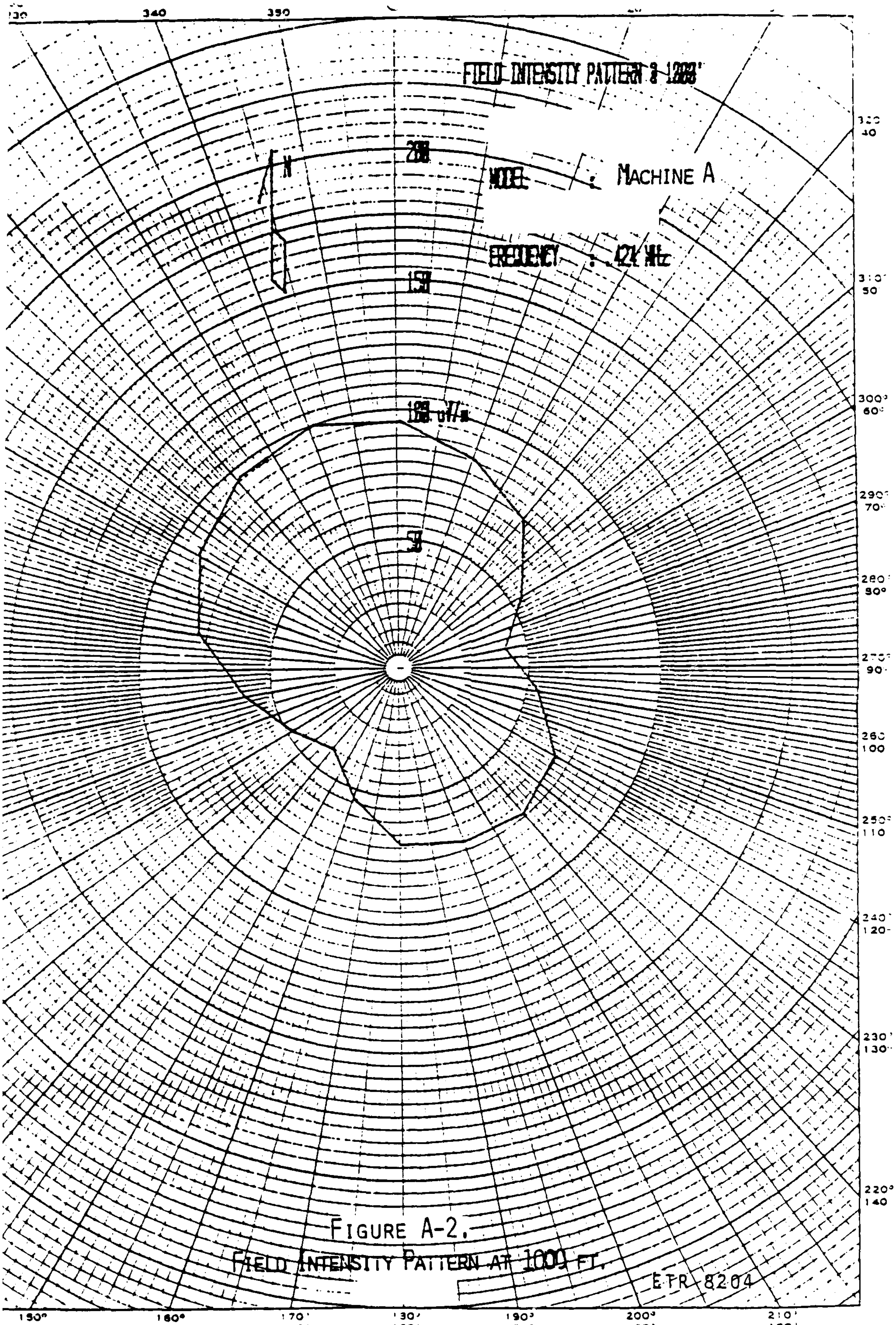

FIGURE A-2.
FIELD INTENSITY PATTERN AT 1000 FT.

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

: FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
FACTURER :
L # : **Machine A**
:
: TESTED : OCTOBER 14, 1983

t Distance : 50 Ft. Azimuth : 240 degrees
rections based on a field decay exponent of 1.95

.	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
54	23.7	60.8	-78.9	5.6	1.9	10.0
09	5.7	58.0	-78.9	-15.2	0.2	10.0
63	19.2	56.4	-78.9	-3.4	0.7	10.0
18	0.4	55.2	-78.9	-23.3	0.1	10.0
72	0.0	49.7	-78.9	-29.2	0.0	10.0
27	0.2	48.2	-78.9	-30.6	0.0	10.0
81	2.2	46.7	-78.9	-29.9	0.0	10.0
36	1.8	45.7	-78.9	-31.4	0.0	10.0
90	2.1	44.7	-78.9	-32.1	0.0	10.0
44	4.5	43.8	-78.9	-30.6	0.0	10.0

FIGURE A-16.
MACHINE A GROUND TEST 240 DEGREES AZIMUTH

checked by: J. Modica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 220 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
.4254	22.2	60.8	-78.9	4.1	1.6	10.0
.8508	5.9	58.0	-78.9	-15.0	0.2	10.0
.2761	20.0	56.4	-78.9	-2.6	0.7	10.0
.7015	-0.5	55.2	-78.9	-24.2	0.1	10.0
.1269	0.6	49.7	-78.9	-28.6	0.0	10.0
.5523	0.2	48.2	-78.9	-30.6	0.0	10.0
.9776	1.2	46.9	-78.9	-30.9	0.0	10.0
.4030	2.2	45.7	-78.9	-31.0	0.0	10.0
.8284	4.8	44.7	-78.9	-29.4	0.0	10.0
.2538	5.0	43.8	-78.9	-30.1	0.0	10.0

FIGURE A-15.
MACHINE A GROUND TEST 220 DEGREES AZIMUTH

checked by: J. Madica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine A**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 200 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
.4248	24.4	60.8	-78.9	6.3	2.1	10.0
.8496	7.1	58.0	-78.9	-13.8	0.2	10.0
.2744	2.3	56.4	-78.9	-20.3	0.1	10.0
.6992	0.5	55.2	-78.9	-23.2	0.1	10.0
.1240	0.4	49.7	-78.9	-28.8	0.0	10.0
.5487	-0.8	48.2	-78.9	-31.5	0.0	10.0
.9735	2.9	46.9	-78.9	-29.2	0.0	10.0
.3983	1.8	45.7	-78.9	-31.4	0.0	10.0
.8231	2.6	44.7	-78.9	-31.6	0.0	10.0
.2479	3.9	43.8	-78.9	-31.2	0.0	10.0

FIGURE A-14.
MACHINE A GROUND TEST 200 DEGREES AZIMUTH

checked by: J. Modica

ETR 6204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 180 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4248	26.7	60.8	-78.9	8.6	2.7	10.0
0.8495	6.7	58.0	-78.9	-14.2	0.2	10.0
1.2743	2.2	56.4	-78.9	-20.4	0.1	10.0
1.6991	-0.4	55.2	-78.9	-24.1	0.1	10.0
2.1238	0.2	49.7	-78.9	-29.0	0.0	10.0
2.5486	2.3	48.2	-78.9	-28.4	0.0	10.0
2.9734	3.0	46.7	-78.9	-29.0	0.0	10.0
3.3982	1.2	45.7	-78.9	-32.0	0.0	10.0
3.8229	2.0	44.7	-78.9	-32.2	0.0	10.0
4.2477	3.2	43.8	-78.9	-31.9	0.0	10.0

FIGURE A-13.
MACHINE A GROUND TEST 180 DEGREES AZIMUTH

checked by: J. Medina

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 160 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4245	27.1	60.8	-78.9	9.0	2.8	10.0
0.8490	1.6	58.0	-78.9	-19.3	0.1	10.0
1.2735	6.2	56.4	-78.9	-16.4	0.2	10.0
1.6980	1.2	55.2	-78.9	-22.5	0.1	10.0
2.1226	-0.3	49.7	-78.9	-29.5	0.0	10.0
2.5471	0.5	48.2	-78.9	-30.2	0.0	10.0
2.9716	1.2	46.9	-78.9	-30.8	0.0	10.0
3.3961	1.6	45.7	-78.9	-31.6	0.0	10.0
3.8206	3.2	44.7	-78.9	-31.0	0.0	10.0
4.2451	2.9	43.9	-78.9	-32.2	0.0	10.0

FIGURE A-12.
MACHINE A GROUND TEST 160 DEGREES AZIMUTH

checked by: J. Modica

ETR 0204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine A**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 140 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4245	27.3	60.8	-78.9	9.2	2.9	10.0
0.8490	1.4	58.0	-78.9	-19.5	0.1	10.0
1.2736	16.4	56.4	-78.9	-6.2	0.5	10.0
1.6981	1.5	55.2	-78.9	-22.2	0.1	10.0
2.1226	-0.1	49.7	-78.9	-29.3	0.0	10.0
2.5471	2.5	48.2	-78.9	-28.2	0.0	10.0
2.9716	2.3	46.9	-78.9	-29.7	0.0	10.0
3.3962	2.2	45.7	-78.9	-31.0	0.0	10.0
3.8207	2.0	44.7	-78.9	-32.2	0.0	10.0
4.2452	4.4	43.9	-78.9	-30.7	0.0	10.0

FIGURE A-11.
MACHINE A GROUND TEST 140 DEGREES AZIMUTH

checked by: J. Modica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine A**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 120 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4247	26.6	60.8	-78.9	8.5	2.7	10.0
0.8495	5.1	58.0	-78.9	-15.8	0.2	10.0
1.2742	15.8	56.4	-78.9	-6.8	0.5	10.0
1.6990	-0.4	55.2	-78.9	-24.1	0.1	10.0
2.1237	0.3	49.7	-78.9	-28.9	0.0	10.0
2.5485	3.0	48.2	-78.9	-27.7	0.0	10.0
2.9732	1.3	46.9	-78.9	-30.7	0.0	10.0
3.3980	1.0	45.7	-78.9	-32.2	0.0	10.0
3.8227	3.2	44.7	-78.9	-31.0	0.0	10.0
4.2474	3.7	43.8	-78.9	-31.4	0.0	10.0

FIGURE A-10.
MACHINE A GROUND TEST 120 DEGREES AZIMUTH

checked by: J. Modica

ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **MachineA**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 100 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4245	24.6	60.8	-78.9	6.5	2.1	10.0
0.8490	3.7	58.0	-78.9	-17.2	0.1	10.0
1.2735	16.4	56.4	-78.9	-6.2	0.5	10.0
1.6980	0.6	55.2	-78.9	-23.1	0.1	10.0
2.1226	-0.4	49.7	-78.9	-29.6	0.0	10.0
2.5471	1.1	48.2	-78.9	-29.6	0.0	10.0
2.7716	1.0	46.9	-78.9	-31.0	0.[illegible]	10.0
3.3961	2.0	45.7	-78.9	-31.2	0.0	10.0
3.8206	2.3	44.7	-78.9	-31.9	0.0	10.0
4.2451	3.2	43.9	-78.9	-31.9	0.0	10.0

FIGURE A-9.
MACHINE A GROUND TEST 100 DEGREES AZIMUTH

checked by: J. Modica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine A**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 80 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4247	22.4	60.8	-78.9	4.3	1.6	10.0
0.8495	6.4	58.0	-78.9	-14.5	0.2	10.0
1.2742	16.0	56.4	-78.9	-6.6	0.5	10.0
1.6989	-0.4	55.2	-78.9	-24.1	0.1	10.0
2.1236	0.9	49.7	-78.9	-28.3	0.0	10.0
2.5484	2.4	48.2	-78.9	-28.3	0.0	10.0
2.9731	2.2	46.9	-78.9	-29.8	0.0	10.0
3.3978	1.1	45.7	-78.9	-32.1	0.0	10.0
3.8226	3.5	44.7	-78.9	-30.7	0.0	10.0
4.2473	3.1	43.8	-78.9	-32.0	0.0	10.0

FIGURE A-8.
MACHINE A GROUND TEST 80 DEGREES AZIMUTH

checked by: J. Modien

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 60 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4247	24.6	60.8	-78.9	6.5	2.1	10.0
0.8493	6.7	58.0	-78.9	-14.2	0.2	10.0
1.2740	16.0	56.4	-78.9	-6.6	0.5	10.0
1.6986	1.6	55.2	-78.9	-22.1	0.1	10.0
2.1233	-0.5	49.7	-78.9	-29.7	0.0	10.0
2.5479	2.1	48.2	-78.9	-28.6	0.0	10.0
2.9726	1.6	46.9	-78.9	-30.4	0.0	10.0
3.3972	1.5	45.7	-78.9	-31.7	0.0	10.0
3.8217	1.8	44.7	-78.9	-32.4	0.0	10.0
4.2465	2.0	43.8	-78.9	-33.1	0.0	10.0

FIGURE A-7.
MACHINE A GROUND TEST 60 DEGREES AZIMUTH

checked by: J. Medina

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 40 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4246	27.3	60.8	-78.9	9.2	2.9	10.0
0.8492	4.9	58.0	-78.9	-16.0	0.2	10.0
1.2738	16.0	56.4	-78.9	-6.6	0.5	10.0
1.6984	0.1	55.2	-78.9	-23.6	0.1	10.0
2.1231	-0.4	49.7	-78.9	-29.6	0.0	10.0
2.5477	2.9	48.2	-78.9	-27.8	0.0	10.0
2.9723	3.4	46.9	-78.9	-28.6	0.0	10.0
3.3969	1.6	45.7	-78.9	-31.6	0.0	10.0
3.8215	2.6	44.7	-78.9	-31.6	0.0	10.0
4.2461	3.3	43.8	-78.9	-31.8	0.0	10.0

FIGURE A-6.
MACHINE A GROUND TEST 40 DEGREES AZIMUTH

checked by: J. Medica

ETR 3204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 20 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4245	28.4	60.8	-78.9	10.3	3.3	10.0
0.8489	3.2	58.0	-78.9	-17.7	0.1	10.0
1.2734	13.8	56.4	-78.9	-8.8	0.4	10.0
1.6979	0.2	55.2	-78.9	-23.5	0.1	10.0
2.1224	0.2	49.7	-78.9	-29.0	0.0	10.0
2.5468	1.0	48.2	-78.9	-29.7	0.0	10.0
2.9713	1.5	46.9	-78.9	-30.5	0.0	10.0
3.3958	1.3	45.7	-78.9	-31.9	0.0	10.0
3.8202	3.6	44.7	-78.9	-30.6	0.0	10.0
4.2447	4.1	43.9	-78.9	-31.0	0.0	10.0

FIGURE A-5.
MACHINE A GROUND TEST 20 DEGREES AZIMUTH

checked by: J. Modica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine A**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 0 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4241	27.4	60.8	-78.7	11.3	3.7	10.0
0.8483	2.5	58.0	-78.9	-18.4	0.1	10.0
1.2724	15.5	56.4	-78.9	-7.1	0.4	10.0
1.6965	1.5	55.2	-78.9	-22.2	0.1	10.0
2.1207	0.4	47.7	-78.9	-28.8	0.0	10.0
2.5448	2.6	48.2	-78.9	-28.1	0.0	10.0
2.9689	1.9	46.9	-78.7	-30.1	0.0	10.0
3.3931	1.5	45.8	-78.9	-31.7	0.0	10.0
3.8172	2.1	44.8	-78.7	-32.1	0.0	10.0
4.2414	4.8	43.9	-78.9	-30.3	0.0	10.0

FIGURE A-4.
MACHINE A GROUND TEST 0 DEGREES AZIMUTH

checked by: J. Modica

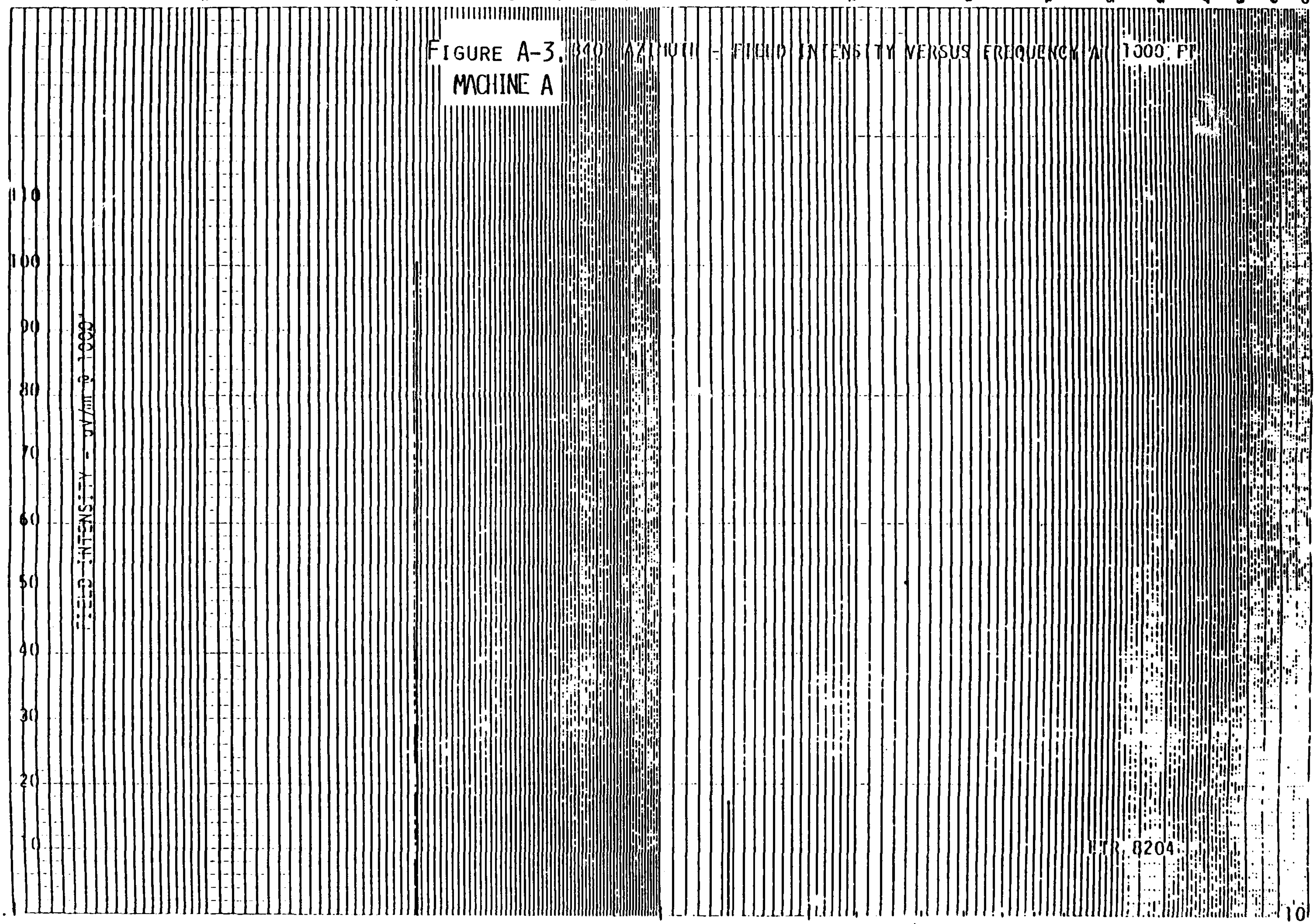

FIGURE A-3. 340 AZIMUTH - FIELD INTENSITY VERSUS FREQUENCY AT 1000 FT.
MACHINE A

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 260 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4265	25.8	60.8	-78.9	7.7	2.4	10.0
0.8531	1.0	58.0	-78.9	-19.9	0.1	10.0
1.2776	19.1	56.3	-78.9	-3.5	0.7	10.0
1.7062	0.5	55.2	-78.9	-23.2	0.1	10.0
2.1327	-0.5	49.7	-78.9	-29.7	0.0	10.0
2.5593	-0.7	48.1	-78.9	-31.5	0.0	10.0
2.7858	1.1	46.8	-78.9	-31.0	0.0	10.0
3.4124	1.2	45.7	-78.9	-32.0	0.0	10.0
3.8389	3.4	44.7	-78.9	-30.8	0.0	10.0
4.2655	3.7	43.8	-78.9	-31.4	0.0	10.0

FIGURE A-17.
MACHINE A GROUND TEST 260 DEGREES AZIMUTH

checked by: J. Modin

ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 280 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4272	28.1	60.8	-78.9	10.0	3.1	10.0
0.8545	0.0	58.0	-78.9	-20.9	0.1	10.0
1.2817	19.2	56.3	-78.9	-3.4	0.7	10.0
1.7090	0.4	55.2	-78.9	-23.4	0.1	10.0
2.1362	1.0	49.7	-78.9	-28.2	0.0	10.0
2.5635	0.3	48.1	-78.9	-30.5	0.0	10.0
2.9907	2.4	46.8	-78.9	-29.7	0.0	10.0
3.4180	2.1	45.7	-78.9	-31.1	0.0	10.0
3.8452	3.8	44.7	-78.9	-30.4	0.0	10.0
4.2725	4.9	43.8	-78.9	-30.2	0.0	10.0

FIGURE A-18.
MACHINE A GROUND TEST 280 DEGREES AZIMUTH

checked by: J. Modica

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 300 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4265	29.1	60.8	-78.9	11.0	3.5	10.0
0.8529	2.4	58.0	-78.9	-18.5	0.1	10.0
1.2794	17.1	56.3	-78.9	-5.5	0.5	10.0
1.7058	0.0	55.2	-78.9	-23.7	0.1	10.0
2.1323	-0.8	49.7	-78.9	-30.0	0.0	10.0
2.5588	0.8	48.1	-78.9	-30.0	0.0	10.0
2.9852	3.2	46.8	-78.9	-28.9	0.0	10.0
3.4117	2.5	45.7	-78.9	-30.7	0.0	10.0
3.8381	3.1	44.7	-78.9	-31.1	0.0	10.0
4.2646	6.1	43.8	-78.9	-29.0	0.0	10.0

FIGURE A-19.
MACHINE A GROUND TEST 300 DEGREES AZIMUTH

checked by: J. Modic

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 320 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4263	29.7	60.8	-78.9	11.6	3.8	10.0
0.8526	4.8	58.0	-78.9	-16.1	0.2	10.0
1.2789	19.5	56.3	-78.9	-3.1	0.7	10.0
1.7052	0.3	55.2	-78.9	-23.4	0.1	10.0
2.1315	0.1	47.7	-78.9	-29.1	0.0	10.0
2.5578	0.8	48.2	-78.9	-30.0	0.0	10.0
2.9841	1.7	46.8	-78.9	-30.4	0.0	10.0
3.4104	3.1	45.7	-78.9	-30.1	0.0	10.0
3.8367	3.9	44.7	-78.9	-30.3	0.0	10.0
4.2630	5.6	43.8	-78.9	-29.5	0.0	10.0

FIGURE A-20.
MACHINE A GROUND TEST 320 DEGREES AZIMUTH

checked by: J. Modin

ETR 8204
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine A
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 340 degrees
Corrections based on a field decay exponent of 1.95

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4260	30.0	60.8	-78.9	11.9	3.9	10.0
0.8521	7.1	58.0	-78.9	-13.8	0.2	10.0
1.2781	19.5	56.3	-78.9	-3.1	0.7	10.0
1.7041	-0.3	55.2	-78.9	-24.0	0.1	10.0
2.1301	-0.9	49.7	-78.9	-30.1	0.0	10.0
2.5562	0.5	48.2	-78.9	-30.3	0.0	10.0
2.9822	2.3	46.8	-78.9	-29.8	0.0	10.0
3.4082	2.1	45.7	-78.9	-31.1	0.0	10.0
3.8343	1.3	44.7	-78.9	-32.9	0.0	10.0
4.2603	5.7	43.8	-78.9	-29.4	0.0	10.0

FIGURE A-21.
MACHINE A GROUND TEST 340 DEGREES AZIMUTH

checked by: J. Modica

APPENDIX B

MACHINE B GROUND TEST DATA

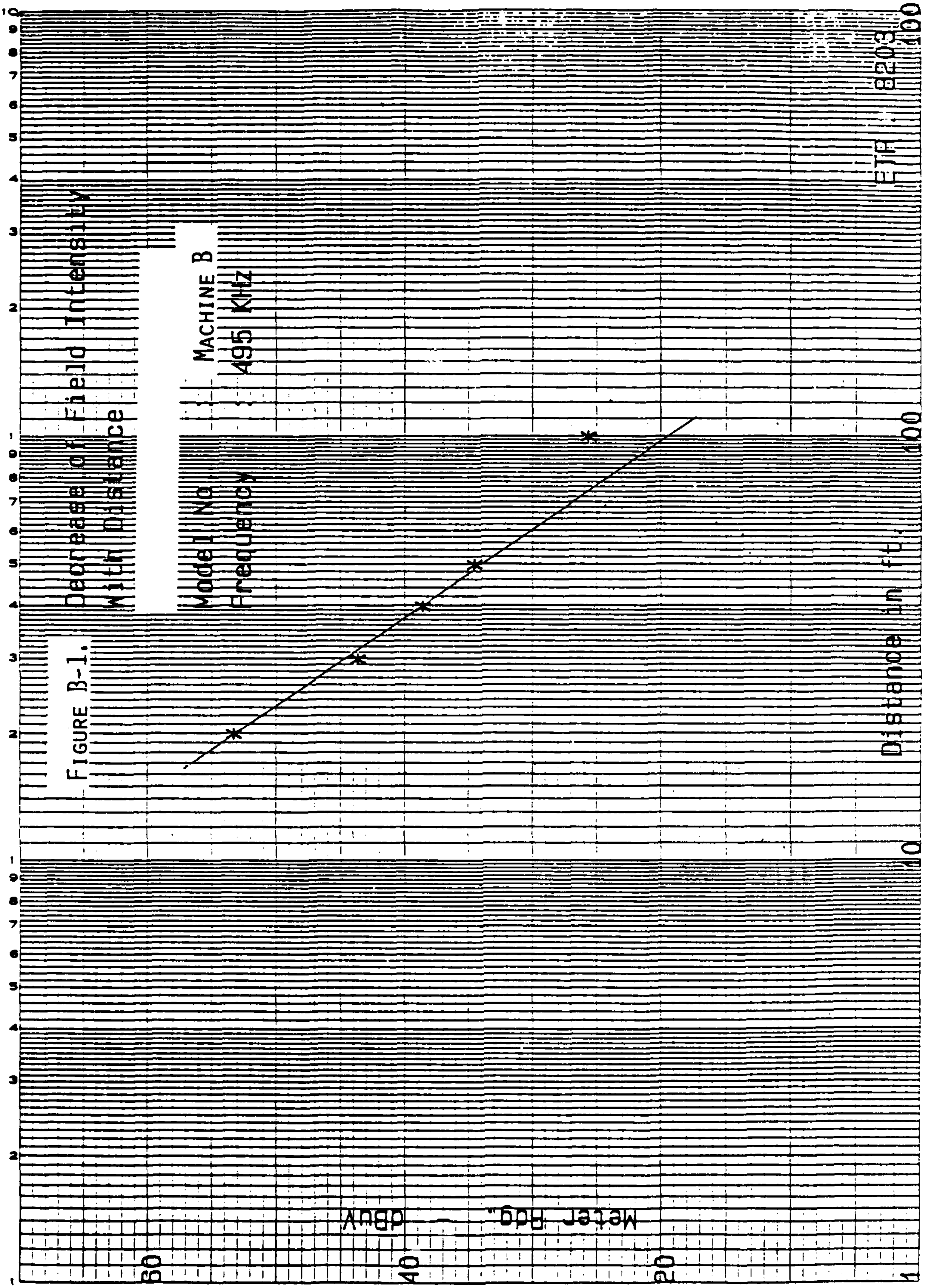

FIGURE B-1. Decrease of Field Intensity With Distance

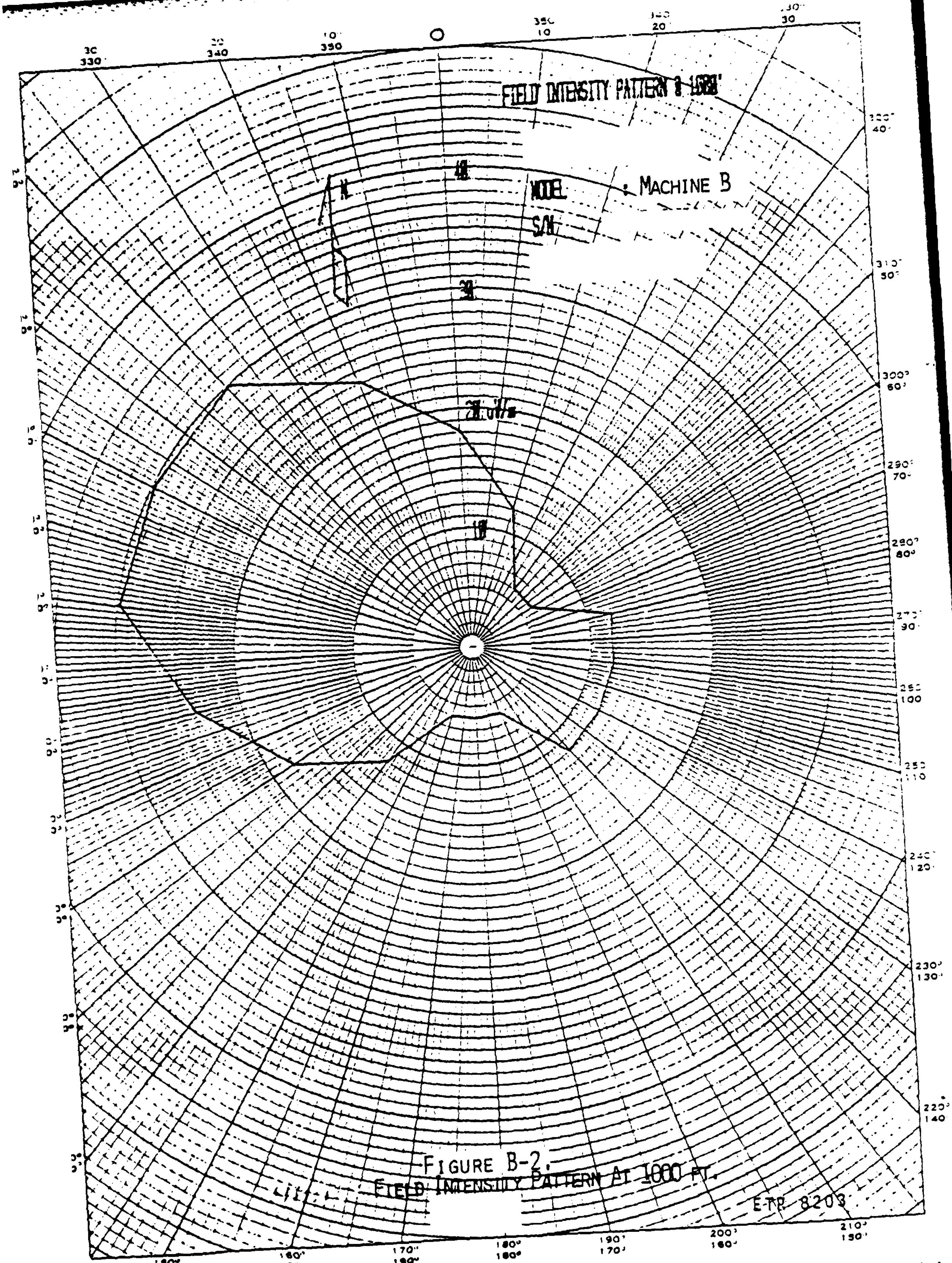

FIGURE B-2.
FIELD INTENSITY PATTERN AT 1000 FT.

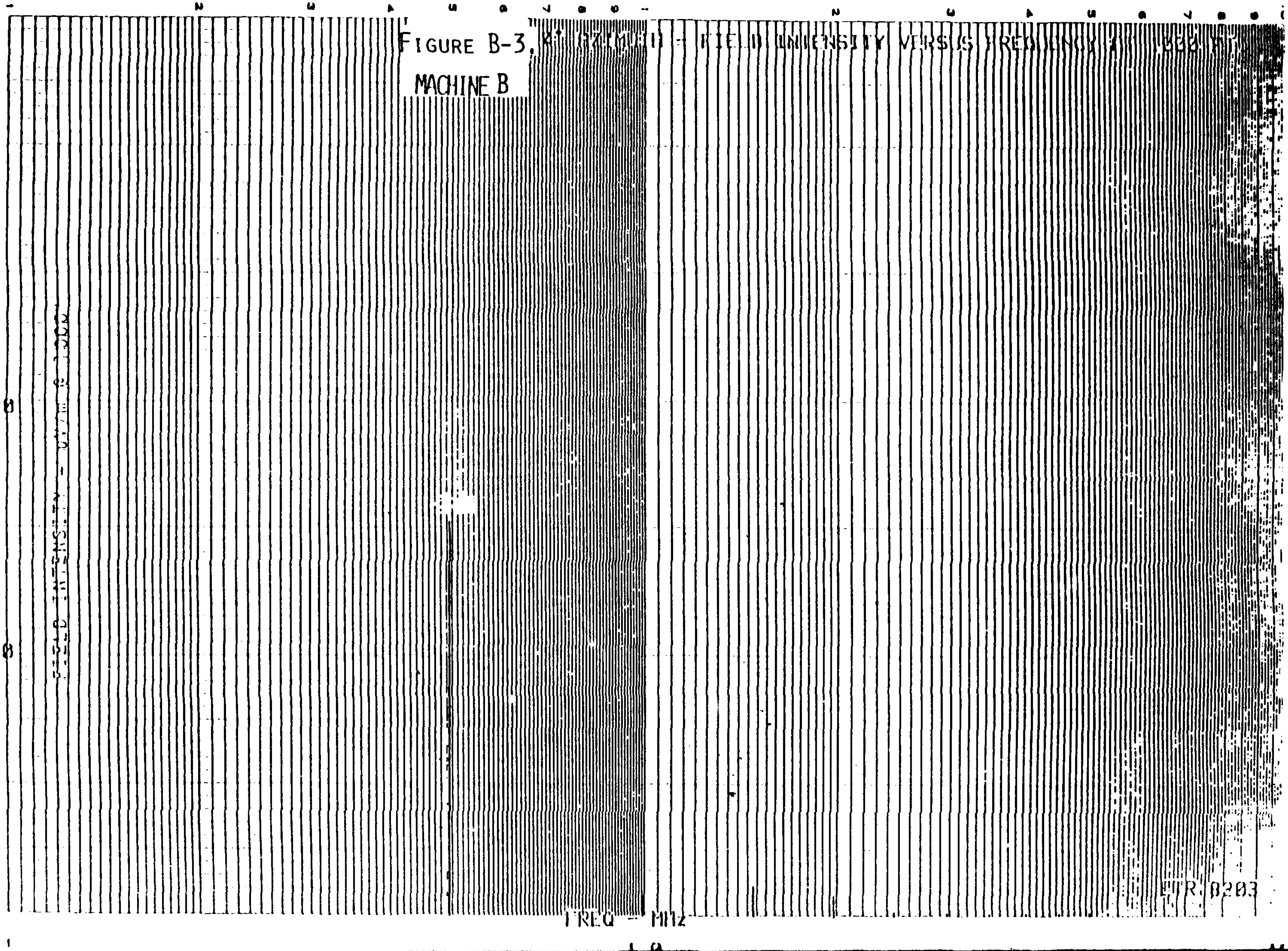

FIGURE B-3, [illegible] - FIELD INTENSITY VERSUS FREQUENCY [illegible]
MACHINE B

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 0 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4751	27.3	60.2	-99.2	-11.7	0.3	10.0
0.9902	5.6	57.4	-99.2	-36.2	0.0	10.0
1.4853	10.2	55.7	-99.2	-33.2	0.0	10.0
1.9804	7.5	54.6	-99.2	-37.1	0.0	10.0
2.4755	0.4	48.4	-99.2	-50.3	0.0	10.0
2.9706	1.4	46.9	-99.2	-50.9	0.0	10.0
3.4657	2.6	45.6	-99.2	-51.0	0.0	10.0
3.9608	0.4	44.4	-99.2	-54.3	0.0	10.0
4.4559	3.4	43.4	-99.2	-52.3	0.0	10.0
4.9510	1.7	42.5	-99.2	-54.9	0.0	10.0

FIGURE B-4.
MACHINE B GROUND TEST 0 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 3203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

:ST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
NUFACTURER :
IDEL # : **Machine B**
N :
TE TESTED : OCTOBER 14, 1983

'est Distance : 50 ft. Azimuth : 20 degrees
orrections based on a field decay exponent of 2.45

eq. Hz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
953	26.7	60.2	-99.2	-12.3	0.2	10.0
'906	6.3	57.4	-99.2	-35.5	0.0	10.0
859	4.3	55.7	-99.2	-39.1	0.0	10.0
'812	8.3	54.6	-99.2	-36.3	0.0	10.0
765	0.7	48.4	-99.2	-50.0	0.0	10.0
'718	1.8	46.9	-99.2	-50.5	0.0	10.0
671	2.3	45.6	-99.2	-51.3	0.0	10.0
'624	2.4	44.4	-99.2	-52.3	0.0	10.0
577	1.8	43.4	-99.2	-53.9	0.0	10.0
'530	2.2	42.5	-99.2	-54.4	0.0	10.0

FIGURE B-5.
MACHINE B GROUND TEST 20 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

:ST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
NUFACTURER :
DEL # : **Machine B**
N :
TE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 40 degrees
Corrections based on a field decay exponent of 2.45

eq. Hz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
1952	21.3	60.2	-99.2	-17.7	0.1	10.0
1903	2.5	57.4	-99.2	-39.3	0.0	10.0
1855	7.4	55.7	-99.2	-36.0	0.0	10.0
1806	1.0	54.6	-99.2	-43.6	0.0	10.0
1758	1.2	48.4	-99.2	-49.5	0.0	10.0
1709	1.0	46.9	-99.2	-51.3	0.0	10.0
1661	1.4	45.6	-99.2	-52.2	0.0	10.0
1612	3.8	44.4	-99.2	-50.9	0.0	10.0
1564	2.3	43.4	-99.2	-53.4	0.0	10.0
1515	1.4	42.5	-99.2	-55.2	0.0	10.0

FIGURE B-6.
MACHINE B GROUND TEST 40 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

ST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
NUFACTURER : .
DEL # : **Machine B**
N :
TE TESTED : OCTOBER 14, 1983

est Distance : 50 ft. Azimuth : 60 degrees
orrections based on a field decay exponent of 2.45

eq. Hz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
252	16.5	60.2	-99.2	-22.5	0.1	10.0
703	6.6	57.4	-99.2	-35.2	0.0	10.0
355	10.2	55.7	-99.2	-33.2	0.0	10.0
306	0.8	54.6	-99.2	-43.8	0.0	10.0
758	0.8	48.4	-99.2	-49.9	0.0	10.0
709	1.3	46.9	-99.2	-51.0	0.0	10.0
661	2.6	45.6	-99.2	-51.0	0.0	10.0
612	1.9	44.4	-99.2	-52.8	0.0	10.0
564	2.0	43.4	-99.2	-53.7	0.0	10.0
515	2.0	42.5	-99.2	-54.6	0.0	10.0

FIGURE B-7.
MACHINE B GROUND TEST 60 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 0203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

ST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
IUFACTURER :
)EL # : Machine B
l :
TE TESTED : OCTOBER 14, 1983

est Distance : 50 Ft. Azimuth : 340 degrees
orrections based on a field decay exponent of 2.45

eq. Hz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
753	31.4	60.2	-99.2	-7.6	0.4	10.0
706	1.3	57.4	-99.2	-40.5	0.0	10.0
359	4.8	55.7	-99.2	-38.6	0.0	10.0
312	5.5	54.6	-99.2	-39.1	0.0	10.0
763	0.4	48.4	-99.2	-50.3	0.0	10.0
718	2.3	46.9	-99.2	-50.0	0.0	10.0
671	1.4	45.6	-99.2	-52.2	0.0	10.0
625	3.3	44.4	-99.2	-51.4	0.0	10.0
578	3.1	43.4	-99.2	-52.6	0.0	10.0
531	2.2	42.5	-99.2	-54.4	0.0	10.0

FIGURE B-21.
MACHINE B GROUND TEST 340 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8293
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

T : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
JFACTURER :
EL # : Machine B
:
E TESTED : OCTOBER 14, 1983

st Distance : 50 ft. Azimuth : 320 degrees
rrections based on a field decay exponent of 2.45

1. z	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
52	32.4	60.2	-99.2	-6.6	0.5	10.0
03	0.9	57.4	-99.2	-40.9	0.0	10.0
55	7.7	55.7	-99.2	-35.5	0.0	10.0
06	8.9	54.6	-99.2	-35.7	0.0	10.0
58	-0.5	48.4	-99.2	-51.2	0.0	10.0
09	2.2	46.9	-99.2	-50.1	0.0	10.0
61	0.9	45.6	-99.2	-52.7	0.0	10.0
12	3.2	44.4	-99.2	-51.5	0.0	10.0
64	0.7	43.4	-99.2	-55.0	0.0	10.0
15	1.4	42.5	-99.2	-55.2	0.0	10.0

FIGURE B-20.
MACHINE B GROUND TEST 320 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 300 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
.4952	32.6	60.2	-99.2	-6.4	0.5	10.0
.9903	-0.5	57.4	-99.2	-42.3	0.0	10.0
.4855	7.4	55.7	-99.2	-36.0	0.0	10.0
.9806	8.6	54.6	-99.2	-36.0	0.0	10.0
.4758	0.5	48.4	-99.2	-50.2	0.0	10.0
.9709	0.9	46.9	-99.2	-51.4	0.0	10.0
.4661	2.7	45.6	-99.2	-50.9	0.0	10.0
.9612	3.6	44.4	-99.2	-51.1	0.0	10.0
.4564	1.3	43.4	-99.2	-54.4	0.0	10.0
.9515	2.2	42.5	-99.2	-54.4	0.0	10.0

FIGURE B-19.
MACHINE B GROUND TEST 300 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 280 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4752	32.3	60.2	-99.2	-6.7	0.5	10.0
0.9903	2.4	57.4	-99.2	-39.4	0.0	10.0
1.4855	6.7	55.7	-99.2	-36.7	0.0	10.0
1.9806	8.5	54.6	-99.2	-36.1	0.0	10.0
2.4758	0.5	48.4	-99.2	-50.2	0.0	10.0
2.9709	1.5	46.9	-99.2	-50.8	0.0	10.0
3.4661	1.5	45.6	-99.2	-52.1	0.0	10.0
3.9612	2.2	44.4	-99.2	-52.5	0.0	10.0
4.4564	1.7	43.4	-99.2	-54.0	0.0	10.0
4.9515	4.6	42.5	-99.2	-52.0	0.0	10.0

FIGURE B-18.
MACHINE B GROUND TEST 280 DEGREES AZIMUTH

checked by: J. Stoffel

CTR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER : ..
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 260 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4952	30.2	60.2	-99.2	-8.8	0.4	10.0
0.9903	5.2	57.4	-99.2	-36.6	0.0	10.0
1.4855	6.8	55.7	-99.2	-36.6	0.0	10.0
1.9806	8.9	54.6	-99.2	-35.7	0.0	10.0
2.4758	2.0	48.4	-99.2	-48.7	0.0	10.0
2.9709	2.6	46.9	-99.2	-49.7	0.0	10.0
3.4661	1.6	45.6	-99.2	-52.0	0.0	10.0
3.9612	4.8	44.4	-99.2	-49.9	0.0	10.0
4.4564	2.2	43.4	-99.2	-53.5	0.0	10.0
4.9515	1.8	42.5	-99.2	-54.8	0.0	10.0

FIGURE B-17.
MACHINE B GROUND TEST 260 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 240 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4953	28.7	60.2	-99.2	-10.3	0.3	10.0
0.9906	8.4	57.4	-99.2	-33.4	0.0	10.0
1.4859	4.4	55.7	-99.2	-39.0	0.0	10.0
1.9812	6.3	54.6	-99.2	-38.3	0.0	10.0
2.4765	-0.9	48.4	-99.2	-51.6	0.0	10.0
2.9718	4.8	46.9	-99.2	-47.5	0.0	10.0
3.4671	3.1	45.6	-99.2	-50.5	0.0	10.0
3.9624	2.2	44.4	-99.2	-52.5	0.0	10.0
4.4577	1.5	43.4	-99.2	-54.2	0.0	10.0
4.9530	1.5	42.5	-99.2	-55.1	0.0	10.0

FIGURE B-16.

MACHINE B GROUND TEST 240 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine B**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 220 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4953	23.1	60.2	-99.2	-15.9	0.2	10.0
0.9907	1.2	57.4	-99.2	-40.6	0.0	10.0
1.4860	5.8	55.7	-99.2	-37.6	0.0	10.0
1.9814	3.6	54.6	-99.2	-41.0	0.0	10.0
2.4767	0.7	48.4	-99.2	-50.0	0.0	10.0
2.9720	2.6	46.9	-99.2	-49.7	0.0	10.0
3.4674	1.3	45.6	-99.2	-52.3	0.0	10.0
3.9627	1.7	44.4	-99.2	-53.0	0.0	10.0
4.4580	4.4	43.4	-99.2	-51.3	0.0	10.0
4.9534	1.5	42.5	-99.2	-55.1	0.0	10.0

FIGURE B-15.
MACHINE B GROUND TEST 220 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 200 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4952	15.8	60.2	-99.2	-23.2	0.1	10.0
0.9903	0.7	57.4	-99.2	-41.1	0.0	10.0
1.4855	7.0	55.7	-99.2	-36.4	0.0	10.0
1.9806	0.5	54.6	-99.2	-44.1	0.0	10.0
2.4758	0.4	48.4	-99.2	-50.3	0.0	10.0
2.9709	1.9	46.9	-99.2	-50.4	0.0	10.0
3.4661	0.9	45.6	-99.2	-52.7	0.0	10.0
3.9612	1.9	44.4	-99.2	-52.8	0.0	10.0
4.4564	1.9	43.4	-99.2	-53.8	0.0	10.0
4.9515	0.7	42.5	-99.2	-55.9	0.0	10.0

FIGURE B-14.
MACHINE B GROUND TEST 200 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 180 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4752	13.4	60.2	-99.2	-25.6	0.1	10.0
0.9903	0.2	57.4	-99.2	-41.6	0.0	10.0
1.4855	8.1	55.7	-99.2	-35.3	0.0	10.0
1.9807	7.1	54.6	-99.2	-37.5	0.0	10.0
2.4758	0.4	48.4	-99.2	-50.3	0.0	10.0
2.9710	0.7	46.9	-99.2	-51.6	0.0	10.0
3.4661	1.7	45.6	-99.2	-51.9	0.0	10.0
3.9613	2.6	44.4	-99.2	-52.1	0.0	10.0
4.4565	1.7	43.4	-99.2	-54.0	0.0	10.0
4.9516	2.2	42.5	-99.2	-54.4	0.0	10.0

FIGURE B-13.
MACHINE B GROUND TEST 180 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 160 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4952	21.7	60.2	-99.2	-17.3	0.1	10.0
0.9904	-0.2	57.4	-99.2	-42.0	0.0	10.0
1.4856	7.3	55.7	-99.2	-36.1	0.0	10.0
1.9808	0.9	54.6	-99.2	-43.7	0.0	10.0
2.4760	0.2	48.4	-99.2	-50.5	0.0	10.0
2.9711	1.2	46.9	-99.2	-51.1	0.0	10.0
3.4663	1.2	45.6	-99.2	-52.4	0.0	10.0
3.9615	1.0	44.4	-99.2	-53.7	0.0	10.0
4.4567	2.1	43.4	-99.2	-53.6	0.0	10.0
4.9519	2.4	42.5	-99.2	-54.2	0.0	10.0

FIGURE B-12.
MACHINE B GROUND TEST 160 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 140 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4952	24.8	60.2	-99.2	-14.2	0.2	10.0
0.9903	4.0	57.4	-99.2	-37.8	0.0	10.0
1.4855	8.8	55.7	-99.2	-34.6	0.0	10.0
1.9807	0.2	54.6	-99.2	-44.4	0.0	10.0
2.4758	0.5	48.4	-99.2	-50.2	0.0	10.0
2.9710	2.3	46.9	-99.2	-50.0	0.0	10.0
3.4662	1.8	45.6	-99.2	-51.8	0.0	10.0
3.9613	1.1	44.4	-99.2	-53.6	0.0	10.0
4.4565	2.6	43.4	-99.2	-53.1	0.0	10.0
4.9517	2.2	42.5	-99.2	-54.4	0.0	10.0

FIGURE B-11.
MACHINE B GROUND TEST 140 DEGREES AZIMUTH

checked by: J. Stoffel

ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : Machine B
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 120 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4752	26.6	60.2	-99.2	-12.4	0.2	10.0
0.9903	1.6	57.4	-99.2	-40.2	0.0	10.0
1.4855	7.9	55.7	-99.2	-35.5	0.0	10.0
1.9807	0.3	54.6	-99.2	-44.3	0.0	10.0
2.4758	1.4	48.4	-99.2	-49.3	0.0	10.0
2.9710	2.9	46.9	-99.2	-49.4	0.0	10.0
3.4662	0.6	45.6	-99.2	-53.0	0.0	10.0
3.9614	0.8	44.4	-99.2	-53.9	0.0	10.0
4.4565	3.2	43.4	-99.2	-52.5	0.0	10.0
4.9517	0.8	42.5	-99.2	-55.8	0.0	10.0

FIGURE B-10.
MACHINE B GROUND TEST 120 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 0203
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER : Machine B
MODEL # :
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 Ft. Azimuth : 100 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4952	26.2	60.2	-99.2	-12.8	0.2	10.0
0.9904	0.4	57.4	-99.2	-41.4	0.0	10.0
1.4855	8.0	55.7	-99.2	-35.4	0.0	10.0
1.9807	0.4	54.6	-99.2	-44.2	0.0	10.0
2.4759	1.4	48.4	-99.2	-49.3	0.0	10.0
2.9711	2.0	46.9	-99.2	-50.3	0.0	10.0
3.4662	3.5	45.6	-99.2	-50.1	0.0	10.0
3.9614	1.8	44.4	-99.2	-52.9	0.0	10.0
4.4566	1.6	43.4	-99.2	-54.1	0.0	10.0
4.9518	2.0	42.5	-99.2	-54.6	0.0	10.0

FIGURE B-9.
MACHINE B GROUND TEST 100 DEGREES AZIMUTH

checked by: J. Stoffel

ETR 8293
ELITE ELECTRONIC ENGINEERING CO.
DATA PAGE

TEST : FCC PART 18D INDUSTRIAL HEATING EQUIPMENT
MANUFACTURER :
MODEL # : **Machine B**
S/N :
DATE TESTED : OCTOBER 14, 1983

Test Distance : 50 ft. Azimuth : 80 degrees
Corrections based on a field decay exponent of 2.45

Freq. MHz	Mtr Rdg dBuV	Ant. fac. dB	Dist. corr dB	Total dBuV/m @ 1mile	Total uV/m @ 1mile	Limit uV/m @ 1mile
0.4947	22.7	60.2	-99.2	-16.3	0.2	10.0
0.9893	2.4	57.4	-99.2	-39.4	0.0	10.0
1.4840	20.0	55.7	-99.2	-23.4	0.1	10.0
1.9787	0.2	54.6	-99.2	-44.4	0.0	10.0
2.4733	0.3	48.4	-99.2	-50.4	0.0	10.0
2.9680	2.9	46.9	-99.2	-49.4	0.0	10.0
3.4627	2.1	45.6	-99.2	-51.5	0.0	10.0
3.9573	1.9	44.4	-99.2	-52.8	0.0	10.0
4.4520	1.5	43.4	-99.2	-54.2	0.0	10.0
4.9467	1.3	42.6	-99.2	-55.3	0.0	10.0

FIGURE B-8.
MACHINE B GROUND TEST 80 DEGREES AZIMUTH

checked by: J. Stoffel

APPENDIX C

ADF CALIBRATION PROCEDURE
August 16, 1983

by

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PURPOSE

The reason for calibrating the ADF receiver AGC voltage versus signal strength is so that unknown signal levels can be determined by correlating the receiver AGC voltage to the calibrated field strength. This calibration procedure was developed for the King KR-86 ADF receiver installed in the Avionics Engineering Center's Piper Saratoga N8238C. The calibration procedure is based on the material presented in reference 1.

EQUIPMENT

Airplane - Avionics Engineering Center's N8238C
Signal Generator - Wavetek 3000 O.U. no. 1298
Field Calibration Unit
SL-802-A Remote Serial I/O Device (SLP)
Heath H89 Computer
ADF Receiver - King KR-86 O.U. no. 1479 (modified to permit disabling of the automatic search and an AGC voltage tap added)

Software:
- SL: Device Driver
- Forth Nucleus
- ADFCAL Forth

Cables:
- RS232 Data Cable
- 50 ohm coaxial, type N connector to BNC connector AC power cord - at least three outlets

SETUP

The FCU must be placed such that the loop antenna of the FCU is one meter from the center of the ADF receiver loop antenna and so that the centers of the two antenna are at the same height. Also, the FCU loop antenna must be oriented for maximum coupling by placing the FCU in a position so that the plane of the loop is perpendicular to a line from the ADF receiver loop antenna to the FCU. All other equipment is to be placed in any convenient location within the limits of the cable lengths.

CONNECTIONS

SIGNAL GENERATOR to FCU:

The requirement is for a 50 ohm coaxial cable type N connector to BNC connector. The cable used is a five foot long RG-58 coaxial cable with BNC connectors on each end and a BNC to type N adapter used for connection to the signal generator.

The cable runs from the "RF OUT" connection of the signal generator to the "EXT IN" connection of the FCU.

SLP to H89:

The male end of the RS232 cable connects to port 320 of the H89 computer and the female end of the cable to the male HOST port of the SLP. The Transmit Pin Select switch for the HOST port of the SLP should be in the "XMIT 2" position. The Baud rate of the SLP is to be set to 9600 and the unit select character to a CNTL-V (0001 0110), where 0 means closed and 1 means open. The Baud rate and unit select character are both set via DIP switches on the back of the SLP.

ADF RECEIVER to SLP:

The two wires protruding through the front of the KR-86 (the AGC voltage tap) are to be connected to the channel 0 analog input of the SLP. The blue wire (AGC voltage) is connected to pin 1 of the analog I/O connector and the black wire (ground) connected to one of the ground pins of the analog I/O connector (pins 20-28).

PROCEDURE

With the equipment properly set up as described in the previous section, perform the following steps.

1) Set the ADF receiver to the desired test frequency with the mode switch to ADF and the added switch (located between the mode switch and the volume knob) in the up position. Turn the ADF receiver on and set the volume to any desired level.

2) Turn on the signal generator, set the output frequency to the desired test frequency, and set the RF output level to the desired signal level. A sample of suggested output levels is shown on the ADF CALIBRATION form in figure 1.

3) Find the position of the maximum signal by rotating the goniometer in small steps and reading the receiver AGC voltage (maximum AGC voltage corresponds to maximum received signal in the KR-86). The goniometer is rotated in small steps by momentarily depressing the test button with the added switch in the up position and then releasing the test button and putting the added switch in the down position to disable the receiver's ability to search for the null field. The AGC voltage is read on the H89 computer using the ADFCAL Forth.

   The maximum AGC voltage should occur when the pointer of the KR-86 is in the direction of the FCU (relative to the location of the receiver's loop antenna). Note that the test button must be released to read the AGC voltage properly.

4) Record the AGC voltage at its maximum level on the ADF calibration form.

5) **Repeat steps 1-4 for each signal level desired.**

6) **Repeat steps 1-5 for each frequency desired.**

ADF CALIBRATION				
DATE:	OPERATOR:			
LOCATION:				
SIGNAL GENERATOR SETTING		E FIELD	AGC VOLTAGE	
frequency (kHz)	RF level (DBM)	(dB above 1 V/m)	VOM	SLP
300	+7	79.0		
300	+3	74.0		
300	-3	69.0		
300	-7	63.0		
300	-13	57.0		
300	-17	52.5		
300	-23	47.0		
300	-27	42.5		
300	-33	37.0		
300	-37	34.0		
300	-43	27.6		
300	-47	22.8		

Figure 1

REFERENCES

[1] Luebbers, Raymond J., James Irvine, Thomas Mullins, Jerry Bash, "A Method of Calibration of Airborne ADF Receiver AGC in Absolute Volts-per-Meter," Avionics Engineering Center, Department of Electrical Engineering, Ohio University, Athens, Ohio; October, 1979.